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ABSTRACT

The monograph is intended to offer educators a systematic approach to using electronic technology and computers with students having multiple handicaps. A model is presented which features a top down approach to curriculum with emphasis on developing age-appropriate functional skills useful in future environments. A training sequence based upon pupil ability to access electronic equipment and computers is outlined. The long term functional benefits of teaching students to use computers and electronic equipment is stressed. Processes are suggested for matching students to computer hardware and software. The chapter on communication and technology gives examples of training activities and use of various types of equipment. Another chapter focuses on integrating use of technology into the daily instructional routine. The last chapter illustrates use of technology with individual students with severe and profound handicaps. Also provided are an instructional progression and decision making flow chart, a computer evaluation form, software review and software inventory forms. A list of resources lists equipment and software (with addresses of sources) in the areas of: switch training and communication, software for concept and language development, learning tools, voice output, other output devices, switches and switch interfaces, and alternate keyboard and input devices. (DB)

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INTEGRATING COMPUTERS AND ELECTRONIC TECHNOLOGY INTO THE CURRICULUM FOR STUDENTS WITH MULTIPLE HANDICAPS

By

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Introduction

The purpose of this monograph is to assist professionals in the process of applying a systematic and purposeful approach to using electronic technology and computers with students having multiple handicaps. It is written with the assuption that the readers have some access to a variety of technological equipment and have some familiarity with its operation.

The students we worked with in the process of developing this project were all multiply handicapped and ranged intellectually from profoundly mentally retarded to mildly mentally retarded. All required special adaptations to access computers and other technological devises.

The project was born from the frustration we experienced in attempting to adapt technology and computers to the needs of students with multiple handicaps. We suspected that other programs similar to our own were having equal difficulty with appropriate application of new technology. To date, we have not seen a rationale or organizational structure which would assist us in systematically planning or directing our instruction on use of technology by students with multiple handicaps. In our efforts to learn more about the use of computers with multiply handicapped students, we obtained the assistance of Dr. Liz Lahm of the Council for Exceptional Children, the McCombs Project staff, and obtained information from the Assistive Devises Network at the University of Iowa.

The first problem we faced was simply the fact that we were all novices when technology and computers became available in classrooms for multiply disabled students. We experienced huge difficulties in obtaining technical training and support for the equipment we purchased. Specialty equipment, such as, electronic language boards came with poorly written manuals and unreliable components. Phone calls to manufacturers and person to person contact at national convention sites provided little benefit. Over time, we were able to find training workshops in other states and spent many a frustrating hour teaching ourselves. This monograph will not provide guidance on the technical or training challenges that teachers and therapists will face when attempting to use computers and other technology. We recommend that school programs take

advantage of training at conferences, such as, Closing the Gap held annually in Minneapolis, Minnesota. The training will save many hours of frustration.

Once some of the technical training hurdles were crossed, we found that we did not have a rationale or empirically based course of action to teach use of electronic and computer equipment. We had no learning sequence. We had not articulated long-term goals for students and we had no rationale for using the equipment within the context of our curriculum. Our curriculum is built upon a model featuring a top down approach with emphasis on developing age-appropriate functional skills that will be useful in future environments.

This monograph focuses on this second problem area. We attempted to illustrate a training sequence based upon pupil ability to access electriconic equipment and computers. Emphasis is given on the long term functional benefits of teaching students to use computers and electronic equipment. Futher, suggested processes are discussed for matching students to computer hardware and software. The chapter on communication and technology gives example of training activities and use of various types of equipment. The fourth chapter focuses on integrating use of technology into the daily instructional routine, and the fifth chapter illustrates use of technology with individual students with severe and profound handicaps.

Chapter I

Preparing Students with Multiple Handicaps for the Future

by Laurence R. Sargent, Ed.D.

Students enrolled in public school today will spend most of their lives in the 21st Century. Predictions from futurists suggest that their lives will be very different from what we know today. One of the prime reasons for this change has been the phenomenal growth of computers and other electronic technology (Cain & Taber, 1987). Much of this technology will assist the disabled individual far greater than it does now. With some adult handicapped and normal intelligence physically handicapped students, technology is already greatly impacting their ability to communicate and develop forms of independence and self-sufficiency. Unfortunately, multiply disabled students are less able to benefit from these innovations. As a result, it is important that special educators develop strategies for the purpose of systemically taping the benefits of technology for lower functioning and multiply handicapped individuals.

To educate multiply handicapped students for life in the 21st Century, educators must become prepared to use many forms of electronic and computer based technology. These scientific applications offer great promise to children with multiple and severe disabilities. The purpose of this chapter is to provide educators and therapists with a theoretical model for using electronic and computer technology with their multiply impaired students. This model represents a synthesis of concepts found in the professional literature which address learning and curriculum from a developmental perspective and from literature which emphasizes functional and age-appropriate instruction. Although tied to curriculum, all instruction as it occurs within this model is provided as a result of following a series of decision paradigms.

Population

The students for whom we have created this model demonstration project range cognitively from profoundly mentally retarded to normal intelligence with all having a range of motor impairments ranging from moderate to profoundly disabling. Most of the students to whom we will refer are non-ambulatory and they have little ability to access computers or electronic technology by normal means. Our field test of procedures included children ranging in age from 3 to 12,

but many applications are appropriate for older students. Nearly all of the students require some form of switch interface to opperate technological equipment or computers.

The Need to Create New Ways of Using Technology

Use of electronic and electrical technology can no longer be considered a breakthrough in the education of children with multiple handicaps. Burkhart (1980, 1982) wrote one of the early manuals on making and using microswitches with severely handicapped students. These early miscroswitch based activities brought great excitement to those working with multiply impaired children. The microswitch was seen as a way for teachers and therapists to get profoundly retarded and profoundly motorically involved students to interact with their environment. Children operated switches to turn on flashing lights, play music, operate battery operated toys, and make noises. Accompanying switch innovations, computer software was developed which allowed switch users to change colors and shapes on the video screen, present letters and symbols, and play games. In 1982, the outlook for functional computer use by severely and multiply involved students did not look promising (Vanderheiden, 1982).

During these early attempts to use a variety of switches, little was done to look at how these technological tools fit in with longitudinal goals for students. Microswitches were no more functional in their use than many of the old pegboard and bead stringing activities of earlier years. The same can be said for use of computers with multiply impaired students. The popular press provided a number of examples where disabled people were able to access high technology to make themselves competent communicators and even make a living. In an effort to keep up with the times, many special education programs purchased computers and the vast array of peripherals that allowed the handicapped child access to computers. In addition, parents insisted that their children have access to computers and be assured computer time in school. Unfortunately, computers were too often used without any intended long range outcome for students. Computers served as stimulating play activities and parent appeasement devices but failed to fit into the context of a functional and age appropriate curriculum. It was obvious that mentally competent individuals could use computers for practical purposes, but the challenge to educators working with multiply handicapped students, most of whom are cognitively impaired, was to use technology and computers for longitudinal and

functional purposes. This model demonstration project was intended for the purpose of examining the state-of-the-art in using electronic technology and computers in ways that contributed to long term benefit for students.

Functional Use of Technology

Electronic technology promises to assist the handicapped individual with many aids that can contribute to adult independence. Voice synthesizers can speak for the non-vocal person, computers with scanning devices can be used to write for motorically involved individuals and robots can perform many daily living functions for nonambulatory people. As times goes on and the use of artifical intelligence is applied to persons with handicaps, the use of electronic computer based aides will increase. However, the challenge for today is to teach multiply handicapped children to use computers and other electronic technology to make themselves more independent.

Despite the great ability of computers and other electronic technology to perform human tasks, it is not yet possible for computers to speak for the individual who has no language or for a robot to peform tasks for a user that can not formulate directions. Use of this technology with multiply handicapped individuals must be viewed as a continuum of applications. These can range from base level stimulus and response paradigms to sophisticated multi-level problem solving.

Levels of Cognitive Development:

When working with chilren having multiple handicaps, there appears to be a switch access progression which contributes to a student's ability to perform certain types of functions with computers and electronic technology. The order of the progression is conditioning, cause and effect, choice making, sequencing and combined functions, such as, scanning. For training purposes, switch operation training is required prior to entry at the cause and effect stage of application. The definition of terms is as follows:

> **Conditioning:** Conditioning occurs when students are trained to emit specific responses when presented with specific stimuli. Switch training uses this process to teach switch operation and reduce or prevent self-stimulatory switch banging.

Cause and Effect: At this level, the student is able to comprehend that for a volitional act such as operating a switch that there will be an effect. Switch operation may range from direct hand operation to galvanic skin response adaptions. The important aspect is that the student is in control of elicting the effect. An effect will be any operation of an electrical or electronic piece of equipment. An effect could be as simple as turning on a light or as sophisticated as making a cusor change on a computer screen.

Choice Making: To make choices, the student must be able to understand cause and effect. At this level, the student can discriminate between causes by selecting the appropriate switch from other distractors. At a somewhat more difficult level, the student is able to choose between desired effects by selecting a switch from those that provide different effects.

Sequencing: This level of development ranges from very simple sequencing to very difficult. At the simplest level, the student must perform a series of operations, e.g. operate two or more switches, to gain the desired effect. One implication of this level is that the student can not elicit the desired effect through a set of random actions. The lowest performing students can be shaped to sequence through chaining procedures. Other students will learn to sequence through traditional modeling and practice instruction.

Scanning: Scanning is an example of combined functions. The task of scanning implies a sequenced search on the part of the student. For a student to scan, he or she must visually or tactually sequence a search, disciminate and make choices to obtain a desired effect. Scanning may require vertical, horizontal, or circular tracking. Scanning tasks also range from easy to hard.

Upon contact with individual students, teachers will find that students will be at any level of functioning on the progression. Some students will progress through all the levels of development and others will fix or plateau at a single level. Applications instruction continues once a student has fixed at a cognitive level or temporarily plateaued. Applications instruction will procede through a simple to complex continuum until the student plateaus.

Applications Training

Applications are possible at each of the five progression levels necessary for assessing technology and computers by multiply handicapped students. The heart of the entire process of training on the use of computers and other technology is the concept that only the applications have functional value. The simple act of activating a microswitch to make some piece of technology perform is not necessarily educationally valid (York, Nietupski and Hamre-Nietupski, 1985). When selecting an application, there are several factors which should be considered. They are as follows:

1. Is the activity motivating to the individual?
2. Is the activity age appropriate for the individual's chronological age?
3. Do parents and caretakers view it as meaningful?
4. Will it contribute to a degree of independence in the future?
5. Does it fit into a scheme of providing functional instruction of life-long value to students?
6. Is use of the device a learning aid for future acquizition of functional skills?

In sum, if the use of technology and computers does not enhance the student's future happiness and indepenence, it is little more than a non-productive passtime.

Functional Instruction

The progression levels for switch interfacing with electronic and electrical equipment are only part of the potential training sequence for students with multiple handicaps. To integrate instruction at any of the levels into the curriculum, it must be applied at each of the progression levels described above using the guidelines for educational validity. The application component of this model is the most important element in the instructional process. It is only through application of technology that the long term purposes articulated in the curriculum can be achieved. The applications are what make instruction functional. Examples of functional application are presented below for each of the progression levels:

Conditioning:
Not applicable

Cause and Effect:
Turn on/off lamp
Turn on/off radio

Turn on/off TV
Turn on signal requesting attention
Turn on signal meaning hungry
Operates switch to change picture on computer screen

Choice Making:

Chooses switch which operates TV from those that do not.
Selects from switches that operate TV, radio, fan.
Selects from heater or air conditioner.
Selects directional switch on electric wheelchair.

Sequencing:

Operates power on switch and then selects operation.
Turns on TV, selects channel, sets volume control with remote control devices.
Dials 911 on touch tone phone for emergency.

Scanning:

Scans rows of a language board to answer a question.
Scans arrays presented on computer screen and selects to create a change on the computer screen.
Scans numbers in an elevator and selects floor

The most significant aspect of application is that it be directed toward achieving functional longitudinal outcomes. An application at the cause and effect level woud be to press a switch and a toy dog would bark. This may be entertaining to the child, but it is not a desirable outcome of instruction on a longitudinal basis. It also would not be appropriate for older age students. In this project, we conceptualized that reasonable longitudinal outcomes should be persued in the following instructional areas:

Use of Learning Aids--learning to use devices which will assist in learning functional skills.

Leisure Activities

Communications/Interactions

Independence in the Living Environment--this includes the concept of partial participation in daily living activities.

Cultural/Social Awareness

Mobility

Many suggested outcomes are presented on Table I. This matrix is designed to illustrate how applications training can be carried out in functional domains.

Decision Making

Determining where to begin instruction is one of the most critical decisions that teachers make. Multiply handicapped students present so many obstacles to instruction that easy assessment practices are difficult to undertake. To provide guidance for teachers, the following steps are suggested for assessment on adaptive electronic devices and computers for students of elementary school age:

1. Review the intellectual functioning level of the student from previous assessments.

2. If the student has a mild cognitive deficiency or has normal intelligence, evaluate to determine if the student is able to use a combination of functions, such as, scanning.

3. If the student has a moderate mental disability, evaluate for ability to sequence.

4. If the student has a severe mental handicap, evaluate for choice making.

5. If the student has a profound mental disability, evaluate for understanding of cause and effect.

Failure to perform at one level should be followed by evaluation at the next lower level.

Once the start-up level for evaluation has been established, the instructional staff assesses to determine whether or not instruction at that level should be undertaken. For example, a student with a mild mental disability is tested to see if they can scan. If the student can scan, then instruction would focus on training the student to carryout a number of functional longitudinally valid tasks which require scanning. If the student can not scan, the student should be assessed for his or her ability to sequence. If the student can sequence, applied training using sequencing is appropriate. At the same time, instruction on scanning should be attempted. If the student fails to

Table 1

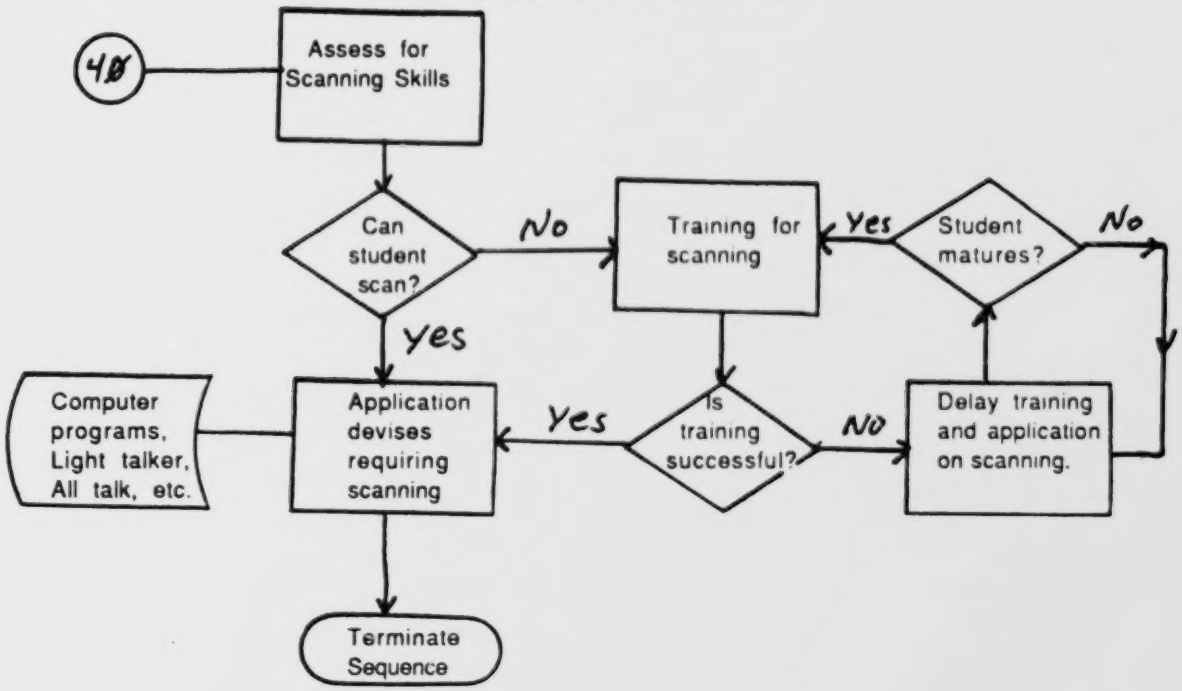
EXAMPLES OF LONGITUDINAL OUTCOMES FOR COMPUTER AND TECHNOLOGY USE

FUNCTIONAL APPLICATIONS

Learning Aids	Leisure Skills	Communciations	Independence in Living Environment (Concept of particial participation applied)	Cultural and Social Awareness	Mobility
Page turners	Operate television	Answer yes/no questions with light or sound indicator	Operate television	Operate television	Operate electric wheel chair
Operation of recorded instruction	Operate Radio	Communicate needs with light talker, all talk, & touch talker	Operate Radio	Operate radio	Communicate wants/needs in community with electronic devises: e.g. light talker, Magic Wand
Computer assisted academic Instruction	Operate tape player	Computer assisted: Power pad, simple light & sound signals	Operate Stereo	Read books/magazines with page turner	
Communication devises to assist in learning: All Talk Light talker Touch talker Computer with voice synthesizer Computer with a scanning devise	Operate page turner	Interact for social purposes: All Talk Light talker Touch talker Magic Wand Computer with a power pad Scanning devises	Operate Blender	Partially participate in many age appropriate activies	
	Operate age- appropriate toys	Interactions through use of computers e.g. use of computer bulletin boards & E-mail.	Operate mixer		
	Play computer games	Operate one touch phone dialer	Operate fan		
			Operate small airconditioner		
			Operate room heater		
			Operate electrical positioning equipment		
			Direct robot to perform chores		

learn scanning within a reasonable number of trials, scanning instruction is delayed until the student matures. Delayed instruction on scanning, however, does not delay applied instruction at the lower levels. The following flow chart of the scanning ***teaching loop*** is provided to illustrate the recommended procedures.

Figure 1
EXAMPLE OF THE TEACHING LOOP FLOW CHART
FOR TEACHING SCANNING



The entire instructional flow chart is located in Appendix A.

The remaining chapters of this monograph address: processes for matching students with hardware and software; communcation and technolgy, integrating technology into instruction for students with mild to mocerate mental delays; and use of technology with students having servere and profound disabilities.

References

Burkhart, L. (1982). Homemade batter powered toys and educational devises for severerely handicapped children. College Park, Md.: Linda J. Burkhart.

Cain, J. & Taber, L. (1988). Educating the Disabled for the Twentieth Century. Boston: College Hill.

York, J., Nietupski, J. and Hamre-Nietupski, S. (1985) A decision-making process for using microswitches. JASH, 10, 214-223.

Vanderheiden, G. (1982) Computers can play a dual role for disabled individuals. Byte, 2, 136-162.

Chapter II

Matching Hardware and Software With Students Having Multiple Handicaps

by Lisa Foss, OTR and Nancy Dunn, M.A., OTR

Computers are important for training today because thery are the tools of tomorrow. However, as they exist today, computers are not always the most important pieces of adaptive equipment for a person with multiple handicaps to master. An electric wheelchair, environmental controls, or a portable electronic language board may be far more useful at the present and in the near future. Despite the lack of immediate applied assistance to master daily life skills, computers are very useful training instruments. Depending on the software selected, they can always provide age-appropriate activity, and they hold the promise of future development that will augment adult independence. Furthermore, they are highly motivating to a wide range of disabled students. In this chapter, processes for matching students to computer hardware and software are presented.

MATCHING HARDWARE TO THE CHILD

When using a computer with multi-handicapped children, there are a number of questions one must answer before introducing the computer to the child. The computer is an expensive tool and should not be used without specific goals in mind. First, one must determine if the child is a good candidate for using the computer. Questions that need to be answered include: "Will the computer provide a better means of educating, entertaining, or allowing for better communication than standard teaching tools?" "What motor movement will the child use to activate the computer?" "What are the child's cognitive abilities?" "What perceptual skills are areas of strength or areas of weakness for the child?" "And finally, what is most motivating for the child?"

Once these questions have been answered, the goals for computer use may be determined. The next step is to determine the most appropriate computer, peripherals, and software to be used. The child must first be properly positioned in a position which provides optimal body support and alignment. The child must be able to concentrate on using his motor abilities to access the computer and not in trying to maintain an upright posture. The environment in which to teach computer skills and how to integrate those skills into the classroom are also issues which need much consideration and advanced planning.

Assessing The Child

The first step of assessing the child is to determine how he will physically touch the keyboard or peripheral to put information into the computer. Will he use isolated finger movements which will allow him to use a standard keyboard without adaptions, or will he only have a controlled hand swipe and need to access the computer with a switch? The hierarchy of motor movement used to access the computer is as follows:

1. Isolated finger movements of hand to activate the keyboard.
2. Use of one finger or adaptive stick held in the hand to activate single keys on the keyboard.
3. Use of headstick to activate single keys on the keyboard.
4. Use of whole hand to activate an expanded keyboard.
5. Use of whole hand to activate a switch.
6. Use of head to activate a switch.
7. Use of another body movement to activate a switch (eyebrow, foot, etc.)
8. Use of a hand swipe to activate a ribbon switch.

The first 4 steps of the motor hierarchy, allow for a direct select into the computer. This is the most accurate and time efficient means of accessing the computer. It allows the child to make choices and gives him more control of what information is provided by the computer. This also allows for a 1:1 correspondence with what is put into the computer and with what is on the monitor. The last 4 steps of the motor hierarchy use a switch to access the computer software. The switch is used in a cause and effect relationship with the computer. The child activates the switch which allows the computer to proceed to the next phase of the program. This does not allow the child to create, but allows him to respond to the computer. By adding more than one switch to access the computer, the child gains more choices, and therefore has more control over what appears on the monitor. The use of a scanning array allows a child with poor motor control to access the computer using a switch, yet provides more choices and gives the child abilities to create things using the computer. Scanning requires higher level visual perceptual skills and memory. It is less accurate and less time efficient than the direct select method. Children seem to fatigue more quickly when using scanning methods to access the computer.

When determining the motor capabilities of the child, one must evaluate the degree, strength, and location of voluntary control. It must be asked, does the child just keep his hand on the peripheral, does he continually tap it, or does he activate and release it with control? The child's physical range of motion and work tolerance also need to be considered. These are especially important when deciding where to place the computer hardware and peripherals for the child's ease in using the computer.

The second step in assessing the child's ability to use the computer is that of determining his cognitive abilities. This is important for selection of the type of peripheral and software the child will be using. A hierarchy for cognitive skills for somputer use, beginning with the lowest level and proceeding to higher levels is as follows:

1. Conditioning
2. Cause and effect
3. Making choices
4. Picture identification
5. Matching
6. Sequencing
7. Pre-Academics

Children who are at the conditioning or cause and effect stages of cognition are candidates for using a switch to access the computer. The computer provides excellent visual and auditory reinforcement and is frequently used for training motor movements and for leisure activities. However, it is important to determine if the child's needs can be best met on the computer, or if toys which are switch activated are more reinforcing and practical. When evaluating children who are cognitively at the choice making stage, one must determine the number of choices the child can handle. Chilren who are choosing between more than 2 things should be evaluated using an expanded keyboard or a switch with a scanning component. Picture identification and matching skills can be evaluated using a switch with a scanning component or the expanded keyboard. Children who are able to sequence could be ready for higher level scanning arrays provided by the adaptive firmware card or direct select methods using a standard keyboard or an expanded keyboard programmed as a standard keyboard. These are also very useful when teaching pre-academic skills on the computer. There is software available to help evaluate children at each cognitive level.

The final step in assessing the child's abilities is to evaluate his perceptual skills. It needs to be determined if the child has the basic visual and/or auditory skills to receive enough feedback from the computer for it to be a reinforcing educational tool. The following is a list of perceptual skills to be considered:

1. Eye contact with the monitor
2. Maintain attention with vision or hearing
3. Visually tracking-scanning
4. Visual and auditory discrimination (figure ground, spatial relations, auditory discrimination between different sounds)
5. Eye-hand coordination (timing/speed used to activate the switch as the desired visual/auditory cues appears)

The child need not have all of these skills to be a candidate for using the computer. However, these are things that need to be considered when determining the most appropriate peripheral and software.

When these three steps have been completed, the teacher should be able to determine the best motor movement and peripheral for the child. The next step will be to decide how the peripheral can be best adapted to meet the child's physical, cognitive, and perceptual abilities.

Computer Hardware and Peripherals

There are a variety of computers on the market, all with their own strengths and weaknesses. However, our school system has puchased Apple computers and therefore this information will speak to this particular system. We have found the Apple IIe to best meet our needs. It allows us to use a variety of hardware, peripherals, and software which has been designed for multi-handicapped children. Ideally, the following hardware should be available when assessing a child for computer use:

1. Apple IIe Computer or Apple IIGS
2. Disk Drive
3. Color Monitor
4. Printer
5. Echo Speech Synthesizer
6. Adaptive Firmware Card
7. Expanded Memory Card

8. Switch Interface
9. Scooter (for switch interface and powerpad)

The computer peripheral input devices fit into three categories; switches, standard keyboards, and expanded keyboards. All come in a variety of styles and have the potential for adaptions to meet each child's special needs. The types of switches available consist of pressure, ribbon, mercury, light activated, paddle, and joystick. Switches also vary in the amount of pressure required to activate the switch. The type of switch chosen and the correct placement of the switch are a crucial part of assessing the child's ability to activate a switch.

The types of keyboards available are limited to the standard computer keyboard, the Mini Keyboard, and the Unicorn programmed as a keyboard. The keyboard can be easily adapted with a keyguard to act as a guide for children using a headstick or those who have difficulty hitting one key at a time. The repeat key can also be adapted to prevent multiple key activation. Using a keyboard cover to block out unused keys or stickers to mark keys that need to be used are two simple adaptions which help the child to visually attend to the correct keys.

The expanded keyboards are the most versatile types of peripheral input. The following is a list of expanded keyboards that are available:

1. Unicorn board
2. Powerpad
3. Muppet Learning Keys
4. Koala Pad
5. Touch Window

The Unicorn board and the Powerpad each have the ability to be programmed to meet each child's individual needs. The size of the space to be activated and the number of spaces can be adjusted according to the child's motor control, cognition, and perceptual skills. As the child improves, the number of spaces can be increased and/or the size of the spaces decreased. Muppet Learning Keys and the Koala Pad are difficult to use to assess children. They are fun tools to use with a child who is already familiar with the computer. The Touch Window allows the child to touch the monitor to access the computer. It helps children who have difficulty looking at the

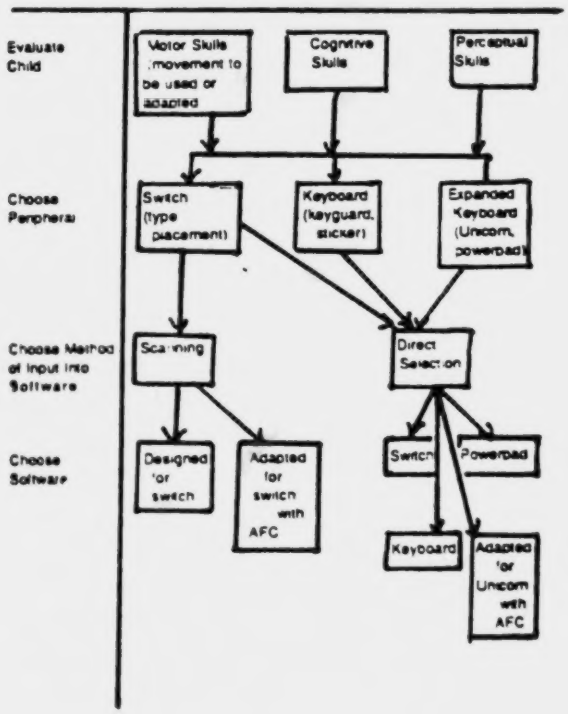
computer as they activate a peripheral with their hand. This peripheral's main drawbacks are the lack of software available for the varying cognitive abilities and the difficulty physically handicapped children have trying to reach against gravity to touch the monitor to activate the window.

The following is a list of peripheral input devices beginning with the one which requires the least motor control and proceeding to those which require more refined control:

1. Single Switch
2. Multiple Switches (2-3 switches)
3. Powerpad
4. Unicorn Board
5. Touch Window
6. Muppet Keyboard
7. Computer Keyboard

Once the peripheral the child will use has been chosen, the next step is to determine the method of input that will be used to access the software. The input of choice is direct select, as previously mentioned. The alternative is scanning. Direct select can be used with a switch, powerpad, keyboard, and the unicorn board (adapted with the adaptive firmware card). Scanning is designed for a switch. Software programs which have not been designed for switch use can be adapted by using the adaptive firmware card. (See flow chart figure 2 and computer evaluation form).

Figure 2
Matching the Student to the Hardware
Flow Chart



Decision making regarding use of periferals can be assisted by completing the Computer Evaluation form located in Appendix B. Once a student is matched with computer peripherals and appropriately positioned, software is the next concern.

SOFTWARE: GETTING ORGANIZED

When computer software and hardware are shared by a large number of staff with varying levels of expertise, organization of the software is helpful. It's difficult to remember the various commands within a program when dozens are being used. Rather than writing this information in a notebook it was made more accessible with a label on the disk jacket itself. A short description of the program, the equipment needed, and how to run the program were included. See Form A in Appendix C. In addition, a reference form was devised which provided more detailed information about the software available in our program. The content of the software as well as the hardware required were evaluated. This pointed staff in the right direction when searching for software appropriate to their students. It was also helpful when not all classrooms have comparable hardware and it's necessary to determine which software is compatible with the available equipment. For example, much of the software cannot be used without an Echo speech synthesizer. Some of the software can be adapted for use by a single switch using an adaptive firmware card. Having this information readily available also allows a staff person to find a substitute program if problems arise with the original one chosen. See Form B in Appendix D.

SOFTWARE: A HIERARCHY

SEQUENCING

SCANNING

CAUSE & EFFECT

COMPLEX PICTURES

GAMES

SIMPLE DISPLAYS

Software used with multihandicapped children can be divided into a hierarchy with cause and effect at the bottom, choice making in the middle, and sequencing at the top. Cause and effect software is the simplest and is designed to teach or reinforce children who are learning that their action on the computer is creating an auditory or visual display. The most basic cause and effect software displays a design on the monitor and or produces a sound or tune when the child touches the switch (e.g. Switch and See, Early Switch Games--visual effects, Fire Organ). Some of these programs are more appropriate when teaching or evaluating cause and effect because of the one to one correspondence between the switch activation and the effect on the monitor. For example, the picture and the song on Switch and See stops immediately when the child releases the switch. This on/off effect is more obvious to a child than when the tune or picture continues until completed, as in Early Switch Games--music. Students having cause and effect will wait until the tune or visual effect is finished before activating the switch again, rather than hitting it randomly. Most confusing to beginners is a program like Fire Organ whose designs change regardless of their switch activation (which changes the type of design only). Cause and effect programs work well for independent leisure activites for those children who are learning the skill as well as those who have mastered cause and effect. One critical characteristic of these simple programs is that as long as the child activiates the program there's no way to fail. In other words, speed and accuracy are not necessary.

Some software includes games which fall into the cause and effect category. Interaction Games has several programs on the disk which require two students to repeatedly activate their switches to compete in a game, e.g. make their colored line get to the top first, push opponent's vehicle off of a hill, etc. For children who have a high level understanding of cause and effect, this provides a nice opportunity for social interaction. One disadvantage is that it encourages banging on the computer as children are competing and using their switches simultaneously. The Motor Training disk has several games which require one or more children to take turns activating their switch to play a game. Again, speed and timing are factors in the completion and good visual perceptual skills are required. Several games on this disk have two functions which are performed with the switch. For example, when using Anti-aircraft, the first touch of the switch results in movement of the aircraft and the second touch fires the guns.

Master Blaster is a program which uses an auditory cue to let students know when to touch their switches. By requiring them to listen, and verbally correcting them for errors, it discourages random pounding or prolonged touching of the switch, and encourages a single quick touch. Most of the higher level switch programs requires students to have this single quick touch. Students who don't understand the concept of competition or how to play the game often still enjoy these types of programs because of the interesting noises and visual effects.

There is a third type of cause and effect program which involves more complex pictures and therefore tends to be more interesting for older or higher functioning children. These types of programs can be used for leisure skills, but also can be expanded to teach language or congitive skills when teacher directed. Included in this group are software such as Hodge Podge, Sticky Bear Opposites, Sticky Bear Letters, Advanced Switch Games--Man of 1000 Faces, Build a Scene. Several of these (e.g. Hodge Podge, Sticky Bears) are designed to teach academic skills such as letters using the keyboard. However, with the Adaptive Firmware Card, a customized array for scanning can be designed so that a child can use a switch to obtain the various pictures and songs with just a knowledge of cause and effect. Since the array is scanned automatically, the child does not need to have any scanning skills to use the programs in this manner. Because of the colorful drawings (some of which are animated) and children's music, these programs are highly motivating for children. Sticky Bear Opposites has the added component of two functions being involved so a child can learn to use two switches--one to change the picture and one to create the opposite animation.

Other software can be used with a switch without the Adaptive Firmware Card. For example, Early and Advanced Switch Games has a program on the disk where children can make a scene--activating the switch results in a new feature (e.g. tree) being added to the scene. Another program, Jimmy Jumper, tells a study about a rabbit. Activation of the switch in this case changes the entire picture on the monitor rather than adding to the picture already on the monitor. In either case, the computer is internally choosing the sequence of pictures and the child elicits the next picture or feature in the sequence by activating the switch.

Choice making is the second level in the software hierarchy. Children can be prepared for this level of activity by using two switches, each of which activates a different battery operated toy.

There is a wide variety of ways choice making can be used on the computer. In its most basic form, an expanded keyboard is divided into two sections with a picture overlay. The child is asked to touch one of the pictures, which results in the computer speaking the word (an Adaptive Firmware Card and program like Control without Keyboards would be required).

Some software such as that produced by UCLA has been specifically designed for the powerpad and provides overlays divided up into grids (e.g. 4 x 4). The advantage is that visual displays on the monitor are an additional component. For example, Wheels on the Bus (UCLA) comes with an overlay of 5 pictures that represent different verses of the song, "Wheels on the Bus". When one picture is touched (e.g. the door) that verse is sung and animated on the monitor. Another UCLA program, Family Fun has a 4 x 4 grid of pictures which says the word and displays the identical picture on the monitor when touched. As a result, while you get the additional feature of visual display on the monitor, you lose the ability to customize (as described in the previous paragraph). Unfortunately software is not yet available which allows for customized overlays and also has the ability to design a visual display on the monitor. This software does lend itself well to group activities and can be individualized for varying levels of students. For instance, one student could be asked to "touch the refrigerator" while another is asked to "touch the thing that keeps our food cold".

The direct selection form of making choices as described above is the easiest to learn from a cognitive viewpoint. However, it requires a certain degree of motor accuracy to touch the pictures. For those students who don't have this motor control, they can make choices using a switch and scanning programs. First Words is a program which requires students to make a choice between two pictures using a switch. They touch their switch in response to a request such as, "Find the fingers". Different categories of pictures are provided which involve varying degrees of difficulty.

A wide variety of scanning programs are available which teach more sophisticated pre-academic skills such as colors, shapes, same and different, and categorizing. Most allow the user to vary the speed according to the child's capabilities. The ones that are well designed, such as Early Concepts, have reinforcement as well as correction procedures built into the program. These drill and practice types of programs require more teacher involvement and typically don't maintain the interest of students as long.

For students who need to be trained in scanning, several programs are available, e.g. Catch the Cow, Rabbit Scanner. Students are not typically very motivated to practice on this type of program unless they are made more interesting by the teacher. Colorforms on the monitor may help children to learn the concept of scanning (e.g. "Hit your switch when the dot gets to the happy face sticker"). Training scanning in off-computer activities may also be helpful.

The highest level of the software hierarchy is sequencing. Here the student can choose from a variety of options and link them together in a desired order. For example, a student learning to use pictures to communicate might touch one representing "want" and then one representing "drink". Or for the student who is working on academic skills, this might involve putting letters together to form a word, or words together to form a sentence. This could be accomplished through either input method--direct selection or scanning. With the multiply handicapped population, direct selection would typically occur through the use of an expanded keyboard and scanning with the use of a switch.

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There are several characteristics which are inherent in certain software that educators should be aware of when ordering or using programs. If independence is a goal, it's impotant to consider whether the program is continuous (e.g. Sticky Bear Opposites) or has a designated number of trials (e.g. Advanced Switch Games--match shapes, Master Blaster). Some programs allow you to specify the number of trials desired. However, if the program has for example, ten trials built in, the child will be done in a short period of time. Another feature to consider is whether the program is designed for the child to be an initiator or a responder. In most of the cause and effect programs the child initiates the interaction with the computer. Unfortunately many of these programs are designed so that the teacher can't predict what picture will come up next. This sometimes limits the potential these programs have for teaching. For example, more than one picture may be associated with each letter on the keyboard as in Hodge Podge, and they come up randomly. At the choice level in the hierarchy, if the child is using the computer to practice preacademic concepts, he will usually be in the role of responder. The computer may verbally request his response or a teacher may need to be present to give directions, at least initially. Motivation may be affected by the child's role as responder versus initiator. A final

feature to consider is whether the program has a built in data collection system. Some programs give a number or percentage of correct responses (e.g. Catch the Cow, First Words, Sight Word Speller). Other record speed of response (e.g. Master Blaster). Several even have the option to print the data (First Words, Catch the Cow, Master Blaster).

ENVIRONMENTAL CONSIDERATIONS

When setting up the computer for regular use by multihandicapped students, educators will need to decide where to place the computer. Should they set aside a special room with all the computer software and hardware and bring the students to that room? Or should they place the equipment on a cart and bring it into each individual classroom? Certainly the amount of available space in the building, the number of classrooms using computers and the number of computers available will have an effect on this decision. The major advantage of having a separate room is the reduction of distractibility. When using a computer in one section of the classroom, it can be distracting to the child learning to use it (who is listening to what the other students are doing) as well as to the other students in the room (who are listening to the sounds coming from the computer). So when a child is learning to use a new program it may be appropriate to use an isolated setting. This also saves time and energy by eliminating the need to set up the equipment each time. Constantly moving and plugging and unplugging peripherals into the computer tends to result in more breakdowns. On the other hand, using the computer exclusively in isolation would not be very functional. In most cases, the computer needs to be integrated into the classroom so that it becomes part of the student's routines.

A decision will also need to be made about the size of the group which will be working on the computer. A large group requires children to wait longer for turns. The interest of the program and the level of functioning of the children will determine if this is a problem or not. Many children find working on the computer individually or with just a teacher is not very motivating. Small groups or dyads are thus a good compromise because it allows for social interaction which increases motivation, but doesn't require children to wait too long for a turn.

Multihandicapped children are often not able to be totally independent on the computer even when using a familiar program. If they are using a switch, they still need assistance to boot the disk, return to the main menu to change programs within a disk, etc. They may also need the teacher to give encouragement and reinforcement.

In addition, the placement of the computer in relationship to the children needs to be considered. It may be a challenge to find a table that places the monitor at eye level, has enough room for the rest of the hardware, and is easily approached by the child's wheelchair or seating device. Children in adapted chairs or wheelchairs will need to be close to an upright position so that their line of vision is horizontal and not up towards the ceiling. When using the computer with a group, it is helpful to have an input device that has a cord long enough to pass from child to child. If the children go up to the computer for a turn, it often blocks the view of the other students who are seated. The input device may need to be stabilized with velcro or dycem, or a special holder devised so that placement is consistent and the device doesn't slide around.

Finally, it's important to have strategies to deal with breakdowns in order to minimize staff frustations. Having at least two persons trained on the computer in each building is helpful for trouble shooting. When attempting to determine which piece of equipment is malfunctioning, it is often necessary to have duplicates of hardware and software to try. Another strategy to save time and frustration is to boot the disk and determine that the program is in working order prior to getting the children ready to use the computer. This also allows you to check and see if the right combination of hardware is hooked up correctly. Unfortunately when several programs (each requiring different hardware) are used in succession, time does not usually allow testing each one prior to getting the children ready. As a result, it helps to have a back up program ready to use and a sense of humor readily available when problems arise.

Many of the software programs discussed in this chapter are appropriate for use with young children. We are anxiously waiting for software developers to write more appropriate programs which can be used with older cognitively low students. After a student becomes proficient using the computer, it is important to move from some of the highly motivating computer activities to more functioal applications using environmental control and stand alone communication devises. The next chapter addresses this topic as well as using computers for communication.

Chapter III
Technology and Communication Training
by Frank Forcucci, MS, CCC-Sp

The concept of an interdisciplinary approach to evaluation and programming is vital when addressing the maximum communication potential for each communication handicapped child. The role of technology has recently played a more important part in meeting the communicative needs of these children.

Communication is not an isolated skill from the student's other abilities and cognition. Communication involves an integration of several abilities including motor, intellectual, social and emotional. Language is learned best in a natural context usually in the home and at school during routine classroom experiences in which simple, stable and meaningful features are learned. Therefore, expertise from each team member is needed (OT, PT, Psychologists, Teachers, Parents, etc.) when evaluating and programming for students with special needs. This collaboration combined with creativity and general knowledge of language development and current technology has proven useful and effective to help children learn new language skills and develop existing abilities with an essential outcome of functional communication.

Communication skills can be enhanced through the use of high technology and micro-computers. At the same time, a student is receiving communication training the student will also be learning basic use of micro-computers, switches, tape recorders, environmental controls and high tech communication aids. The use of the micro-computers for communication training covers a wide range of language skills and student abilities.

For the purpose of this paper will be focusing on the following student functioning levels:

- Severe and Profound Retardation.
- Moderately Retarded.
- Physical and Multiply Handicapped.
- Functioning levels stated above.

Technology can assist students at all functioning levels using a wide range of language. Activities that can begin with Pre-Language Readiness Activities through Receptive and Expressive Language development.

Fortunately many technical aids are available to assist students in their communication development and possibly compensate for their communication disorder. These technical aids are effective in their use across all special education disability categories and for all ability levels. The computer should be a tool of the child instead of a tool for the teacher. This can be accomplished by integrating computer and/or technology based communication programming into the daily classroom routine providing the student a naturally occurring environment for functional language stimulation and development.

Table I provides an overview of communication aids for classroom use. Starting at "Low Technology Services" moving on up to the more sophisticated "High Technology Devices" the table also explains how the student interacts (activates) with the technology. This table can assist classroom teachers and support staff in selection of communication aids.

Table 2: Communication Aids--An Overview

	Communication Aid	Activation
Low Technology	1) Simple Language Boards, Notebooks, Wallets and tactilized boards	-Pointing, light pointers, eye gaze head pointers
	-Yes/no, I'm hungry, potty, drink, want	
	-Mounts on wheelchair tray, hand carried	
	-Expands vocabulary, size varies	
	-Inexpensive	
V	2) Translucent Language Boards	-Head and light pointers
	-Expanded functional vocabulary	-Eye gaze
	-Portable, mounts on wheelchair	-Pointing
	-Inexpensive: $15-$30, Pictures/tray mount	
V	3) Loop tape messages and micro-switch wired cassette tape recorder	-Single or double switches
	-Stored pretaped communications	
	-Single words or connected speech messages	
	-Portable	
	-Inexpensive: $15-40 system Switch, tape, taperecorder	
V	4) Dial scans, light scanning systems talking dolls and voice activated toys.	-Single or double switches
	-Light moves to indicate pictured words	-Light pointer
	-Uses scanning=stop light when on picture	-Voice activation
	-Toy moves when voice activated	
	-Uses direct selection=move light to picture	
	-portable sheel chair mounts	

Table 1 Continued:	Communcation Aid	Activation
|	-Mid price range $40-$150	
V	-Dolls-toys repeat vocalizations	
|		
|	5) Compact typewriter with Mini-	-Direct touch on
High Technology	printer and/or LCD and/or Speech	keyboard keys.
|	synthesis output.	-Head stick pointer
|	-Portable	
|	-High cognition needed by user	
|	-Expensive: $200 and up	
\/	6) Portable software based	-Head pointer
|	communication systems	-Light pointer
|	-Bar code talker	-Hand movement
|	-Mini speak, light taker, touch talker	-Switches
|	All Talk	-Touching expanded
|	-Stores frequently used words or phrases	expanded key-
|	-Human voice/digital speech	boards when used
|	-Robot voice/synthesized speech	with computer
|	-Expensive: $1000-$4000	
V	7) Computer based communication	-Switches
|	systems.	-Touch pads
|	-Control without Keys, Touch Comm,	-Expanded key-
|	Echo texttalker	boards
|	-Some software programs used with	
|	Adaptive Firmware Card	
|	-Expensive $200+ plus Apple II series	
|	equipment and hardware.	
V	-Lots of options for input and	
High Technology	communication training.	

When using the micro-computer in the classroom to assist in communication skill development it is important that the following questions be answered:

1). What is the student's general level of intellectual and adaptive functioning?

2). What is this student's communication level?

3). What is your communication goal for this student?

-Remember language is best taught in the context of a lesson. Examples of functional communication goals are:

- To ask for eat/drink at snack time.
- To make a choice between two objects or activities presented during

classroom work time.
- To ask for common objects in environment during play activites.
- To answer simple wh - and yes/no questions during interaction with classroom staff.
- To understand basic concepts and direction words during classroom activites.
- To express wants and needs.
- To signal to classroom staff that student wants to initiate communication or get adult attention.

4). Does the student respond better to visual stimuli, auditory stimuli, and/or objects:

- Example of computer generated visual stimuli:
  - Bright flashing lights different colors and graphics.
  - Objects moving across monitor screen.
  - Pictures of objects.
  - Printed words and sentences.

- Example of computer generated auditory stimuli:

  - Loud tones and other noises.
  - Words produced by speech synthesis.
  - Musical tunes.

5). What are the student's motor responses that can provide access to computers and other technology?

- Can the student move his/her head, hand, eye brow, knee, etc., with some control? Motor control is needed to access technology. There are several options for alternative inputs and the occupational and physical therapists can be helpful in this area and should be part of the team helping the student meet his goals.

6). What software can help achieve this student's functional communication goals?

- The way the computer is used depends solely on the software you choose. Classroom staff and team members should familiarize themselves with software and its use. Software use should be integrated into the established curriculum for each student. Creativity and adaptations are key words when working with software and special education students.

7). What additional hardware is needed to implement the program?

- Most software programs will list additional equipment needed to run that particular software program. Examples and descriptions of some additional hardware for a student with special needs are listed as follows:

    a. Switches - Range from simple to complex. Push switches are commonly used. Sensitivity varies with each switch. Some common types of push switches are the pedal and lever switches. The switch serves the function of controlling a device.

    b. Switch Interface - is connected to the computer allowing computer access for different types of switches when using single switch option software.

    c. Expanded Keyboards - provide alternative input for computer use other than the standard keyboard. Examples of Expanded Keyboards are as follows:

        1). Unicorn Expanded Keyboard is a flat membrance Keyboard with 128 touch sensitive keys. It is oversized and designed to replace a standard computer keyboard when a flexible, rugged alternative keyboard is required. The 128 inch square key areas can be reconfigured to create larger (but fewer) key areas to accommodate the physical capabilities of the user. Each touch-sensitive area can hold up to 40 characters and can be saved on disk for future use.
        Price Range $100 to $500.

        2). Control Without Keyboards (CWK) is a software-based text input/computer access system that works in conjuction with a Power Pad and Echo Speech Synthesizer. The CWK software is used to program and interpret input from the Power Pad touch sensitive tablet. Through overlays, the

tablet can act as a standard keyboard or any other configuration appropriate to the user. Touch Pad inputs are interpreted by the CWK, sent to the computer and verbalized by the speech synthesizer.
Price Range $100 to $500.

3). Muppet Learning Keys is an oversized membrance keyboard designed especially for use by children. Letters and numbers are arranged in sequence. Other keys are overlayed with pictures of popular Muppet characters. They keyboard works with specially designed educational software
Price Range - $100.

4). Power Pad is an oversized 12" by 12" touch-sensitive alternative keyboard. The Power Pad plugs into the game port of most computers. The Power Pad has various uses but can function as a computer-based communication device.
Price Range - $200.

5.) Adaptive Firmware Card (AFC) is a non-keyboard input interface that is installed inside the computer. AFC allows physically handicapped users to run commerically available software for the Apple Computer. AFC provides 16 different input methods such as scanning and slowdown mode.
Price Range $400+

6). Echo+ Speech Synthesizer - and other speech output devices that plug into the computer. The Echo+ has two voice modes: a limited vocabulary, natural sounding female voice; or an unlimited vocabulary, robotic voice. Echo+ can also generate sound and music effects.
Price Range: $100 - $500.

Table 3 - Computer Assisted Communication Skills (CACS)

A. Pre-Language Readiness Skills
- -Need to Communicate.
- -Develop motivation and independence.
- -Attention visual, auditory and tactile interaction with persons and objects.
- -Teaching and scanning of monitor objects and people.
- -Respond to name.,
- -Cause - effect concepts.
- -Develop long and short term memory.
- -Use a switch for interaction with environment and toys or objects.

B. Receptive Language Skills
- -Choice making.
- -Develop basic functional vocabulary.
- -Knowledge of basic concepts.
- -Understands yes/no and wh? questions.
- -Follows functional commands.
- -Object identification.
- -Auditory discrimination of speech and non-speech sounds.
- -Visual discrimination of shapes and size.
- -Environmental controls for self-help and interaction.
- -Increase speed of response.

C. Expressive Language Skills
- -Express wants and needs and experiences building expressive vocabulary.
- -Alternative speech responses for non-verbal students.
- -Sound imitation and vocal stimulation.
- -Increase signing vocabulary.
- -Make requests.
- -Turn taking in group activities.
- -Help students initate verbalizations.
- -Develop functional verbalizations.

As a speech and language pathologist, my goal for the past twelve years has been to find effective ways to teach children and young adults language. I first started using computers and other technology with children who had little or no expressive language and limited

interaction with environment due to mental retardation and multiple physical handicaps as a result of my frustration with traditional therapeutic methods.

In my work with these students I found that the most control and independence the students develop due to technology the more their receptive and expressive language skills improved.

The technology whether it was a simple switch to toy apparatus or a more complex computer based speech output system gave the students the desire to communicate, the power to easily convey their messages and the feeling of independence probably for the first time. All of these student feelings create the motivation to communicate.

The following are examples of activities for classroom use that combine technology and language development and have been shown useful in facilitating receptive and expressive language for handicapped learners.

Pre-Language Readiness Activities

I). **Goal**: To increase communication skills through the development of cause and effect concepts.

Resources: Single switch, battery operated toys. Cause-effect toys should be used, such as a barking dog, noise and light flashing fire engine, etc.

Activities: The student should be encouraged or prompted to activate switch. The teacher should make sure the toy is in eye and ear view of student before and after toy activation. After student activates toy and toy responds, the teacher should reinforce the student and say, "Look you made the dog jump and bark, good job." This activity should be repeated using a variety eye and ear catching toys until the data shows the child has demonstrated the knowledge of the cause effect concepts. The teacher should always label the toy and its action verbally for the student in simple terms. Such as: "Good Sally, you made the dog bark." This is important because you are associating words with actions and objects making language meaningful for the student through his/her own experiences. Remember, the fuctional purpose of the activity is to increase communication and not simply to have the student operate a mechanical toy dog.

II). **Goal**: To increase communication skills through the development of visual and auditory attention skills.

Resources: Single switch, switch interface Apple IIe, Apple II series computer, color monitors, motor training games, software and a hand held noise maker.

Activites: The student should be encouraged or prompted to activate the switch and look at the color monitor. The motor training software (MTG) program called "colors and tones" provides the student with a visual cue-solid colors - and an auditory cue - a beep tone - when the switch is activated. The teacher should reinforce the student for hitting the switch and looking at the monitor. If the student needs additional cues to respond, the teacher should stand behind the monitor and rattle the noise maker in front of the monitor's screen until the student reacts. Reinforcements should always follow the student's attempts at attention.

III). **Goal:** To increase communication skills through the development of receptive vocabulary.

Resources: switch, switch interface, Apple IIe computer, color monitor, echo+ speech synthesizer and printer, supplemental pictures and First Words software program.

Activities - The student activates the switch when the red box scans the intended vocabulary word pictured on the screen. Reinforcement, both verbal and visual is built into the First Words Program. The classroom teacher should set the program for the words the student needs to learn. Word categories on the software consist of the following:

> Animals, body parts, clothing, common objects, utensils, foods, household items, outside things and vehicles. Instructional levels on the First Words Program are game, interface training, initial training, intermediate training, advanced training and test.
>
> This program at all levels of instruction will print out data for the student.

IV). **Goal:** To increase communication skills through the development of expressive language single-word utterances.

Resources: Power Pad, Apple II Computer, monitor, power pad interface. echo+ speech synthesizer, teacher made power pad overlays and cause-effect toys or functional objects. Touch Comm Software.

Activities: The teacher will make an overlay of the power pad with colored line drawings of the objects the student will use and request. Text for the vocabulary appears both on the power pad template and monitor screen. When the student touches the picture on the template, the word for that picture is spoken in synthesized speech. The student should be taught to use the computer to ask for toys and/or functional objects and label them. Based on my past experiences enhancing augmentative communication through computer use, sign, or picture boards, facilitates a student's desire to verbalize and learn language. The Touch Comm Software can be adapted for all student functioning levels and the template used on the power pad can be used as a portable communication system.

Overview of Stand Alone Communication Devices and Environmental Control Units.

Computers hold great promise for disabled people, but stand alone communication devises and environmental controls provide immediate assistance to persons with multiple handicaps. Stand alone communication devises are portable and therefore may be used in a variety of community settings. The environmental control devises provide the disabled individual some immediate control over his or her living environment. Some of these devises require sophisticated scanning and sequencing skills while others only need to execute on and off switches at the cause and effect level of development.

I. Stand Alone Communication Devices.

A. Alltalk - is a programmable human voice output communication and training aid. It consists of a 16" x 20" membrane keyboard that can be custom configured with overlays. Depending on the user, overlays can vary in size. Real human voice is recorded in memory, then is recalled by touching the template.
Price Range - $2,000 to $5,000.

B. Touch Talker - is a small, portable communication aid featuring synthesized speech, 40 character LCD display, programmable memory and a membrane keyboard. It can be used with an optional printer or can interface with compatible computers in a keyboard emulation mode. It can also interface with Prenthke Romich Company's environmental control unit. Software is needed to make the Touch-Talker a functional device.
Price Range between $2,000 and $5,000.

C. Light Talker - is the same as the Touch Talker but is activated by light pointer.
Price Range $2,000 to $5,000.

D. Zygo 100 - is a row-column or a directed scan communication device. There is a one-hundred open square matrix for display. The Zygo is activated by a switch.
Price Range $500 to $1,500.

E. Dial-A-Scan - is a portable switch activated dial scanner which can be mounted on a wheel chair. Different templates can be made to expand vocabulary.
Price range $45.00 to $65.00.

II. Environmental Control United: (ECU's) are devices disabled student's use to control aspects of their environment. An ECU can activate a variety of devices that are powered by electrical current from wall outlets or by batteries, radios, TV's, tape players, food processors, blenders, microwave ovens, can openers and lights can be controlled by an ECU. More specialized devices such as an automatic page turner, permit independent control of a specific task. ECU's and communication aids can increase independence in the routine activites of daily living only if the user and the available technology are carefully matched.

The use of computers and other electronic devises may not be very productive if their use and training is applied out of the normal context of school and daily living. The following chapter illustrates how one teacher has integrated use of all these peices of technoloy into the daily instructional routine.

Chapter IV

INTEGRATING TECHNOLOGY AND COMPUTERS INTO THE CLASSROOM FOR STUDENTS WITH MENTAL AND PHYSICAL HANDICAPS

by Jane Sandin

In recent years technology made its way into the classrooms for mentally and physically handicapped students. Through the use of technology and computers, these students have become able to communicate, develop functional academic skills and learn daily living skills that previously were impossible for them to do independently.

In this section I will discuss how we incorporated the use of technology and computers into the daily classroom schedule (for students who are mildly to moderately physically and mentally handicapped). The problems we found, and suggestions on how we remedied these problems are discussed. A typical day in our classroom is presented to illustrate how instruction is integrated into curriculum which focuses on functional academics and life skills. Each segment will include how we integrated therapeutic positioning, technological equipment and computers to best equip the students for achieving both academic and life skills goals. We will also discuss how current instruction fits with the long term goals for our students in the years to come.

To start, I will give a brief description of our classroom make-up. This year we have had up to 8 students, but no more than 6 students at a time. Our classroom staff consisted of teacher, two associates and a foster grandmother. Our students, ages 7 - 10, have mild, moderate or severe mental and physical disabilities.

Students:

BJ is an eight year old who has cerebral palsy/quadriplegic, functioning in the mild range of mental retardation. BJ communicates through the use of pictorial/word language boards and through facial gestures, eye-gazes and vocalizes sounds such as a cough for getting your attention. BJ uses a wheelchair for his mobility. Due to extreme physical problems he is dependent in all self-care areas.

CJ is a ten year old who has cerebral palsy/quadriplegic, functioning in the mild range of mental retardation. He communicates through a language board system and light talker. He can verbalize a few words and has excellent eye-gaze skills. He uses an electric wheelchair for his mobility. He is dependent for most self-care needs.

DJ is an eight year old who has cerebral palsy that has affected his speech and fine motor control, and he is ambulatory. This past year he has spontaneously verbalized several words, using one to two word responses to communicate his needs or thoughts. He relies on an alternative communication system such as the magic wand with a bar code communication board and a pictorial/word language board. He is functioning in the mild range of mental retardation. He can perform many daily living skills independently.

KJ is a seven year old who has cerebral palsy. He is ambulatory with assistance of a walker and adult supervision in the classroom. He uses a wheelchair to propel himself in the building . KJ is verbal and functions in the moderate range of mental retardation.

MJ is a seven year year old cerebral palsy student with some physical limitations. He can use a walker to move around in the classroom with adult supervision. He can properlhimself outside the classroom in his wheelchair. MJ is non-verbal but does make some sounds to get your attention. He also uses gestures and a few signs to communicate his needs. He is functioning in the severe range of mental retardation.

PJ is an eight year old boy functioning in the moderate range of mental retardation. He is verbal and ambulatory.

All of the students who require switch access to technology and computers are at the combined level on the access progression.

Each school year brings many challenges to the classroom teacher. Through the past few years I have faced many of these challenges in working with students with multiple physical handicaps with varying degrees of mental retardation. As I set up my classroom for the year, I go through a checklist for each student to decide what should be taught and how it should be taught.

INDIVIDUAL CHECK LIST

1. After setting up your daily schedule, set up goals for each block of time in the schedule. Ask yourself, "What do I want to see accomplished during this block of time this year?"

2. In evaluating the goals for each block of time, look at the long-term goals to see if what we are setting out to accomplish will be beneficial for the child's adult life. (This should also be used in setting up and evaluating the students IEP goals).

3. What are the student's strengths and weaknesses?

4. Where is the student functioing cognitively?

5. How does the student communicate?

6. Does the student have any physical limitations?

7. What are these limitations?

8. Where does the student have the best control in determining switch operation for computers and other forms of technology?

9. Consider the students diagnosis and medical problems that may affect the use of certain types of equipment and how functional it would be for the student on a long-term basis?

10. What types of equipment would best assist the student in achieving his goals during that block of time?

11. Determine the best position for that student in using a certain type of equipment. The therapists need to be consulted in this area.

Using the check list will be helpful in developing the student's IEP goals for the year. In writing my goals I inlcude the position the student is to be in and the type of adaptive equipment to be used in helping the student achieve the main goal. Through the use of this check-list it has helped to develop realistic, achievable goals for the student.

BUILDING IN TECHNOLOGY USE INTO THE DAILY ROUTINE

The schedule for each day is different in our classroom. I have chosen Tuesday's schedule plus art class and community mobility to provide examples of how technology is integrated.

TUESDAY'S SCHEDULE

8:10 - 8:30 ARRIVAL

8:30 - 9:00 CIRCLE (HOMEROOM)

9:00 - 9:30 LANGUAGE/READING

9:30 - 10:00 MATH/NUMBERS

10:00- 10:30 MORNING BREAK

10:30- 11:00 WRITING/SPELLING

11:00 - 11:45 LUNCH FOR STUDENTS

11:45 - 12:30 LEISURE ACTIVITES

12:30 - 1:00 VOCATIONAL

1:00 - 1:30 LANGUAGE

1:40 - 2:15 MUSIC

2:15 - 2:20 BUS LOADING

OCCURRING TWO TIMES WEEKLY: ART AND COMMUNITY MOBILITY

To meet the needs of all of the students it is necessary to integrate use of technology, physical therapy, and occupational therapy into the daily instructional routine.

Morning Language Circle:

Each day we begin with circle, taking attendance and lunch count, students choosing their weekly jobs, working on language skills, discussing the days activities, and provide a time for the students to share with their friends what they have been doing outside of school.

Adaptive equipment used during this time include: circle communication boards, optical light pointers, touch talker, headsticks, magic wand with bar code communication book for circle, supine stander and BJ's equipment for his weight stretching program.

Before circle begins BJ is positioned in his wheelchair with the weight stretching program in place. MJ is in the supine stander for his stretching program. CJ is in his wheelchair and DJ, KJ and PJ are sitting at the table. BJ has a communication board on his tray and is wearing his optical light pointer. MJ has the same type communication board for circle placed on his tray. CJ has the Touch Talker placed on a wooden wedge for easy visability and access to the individual spaces. He uses his headstick to operate the talker. DJ has the Magic Wand and bar code communication book for circle placed on the table. The main unit of the magic wand has been placed in a cardboard container that is strapped to the back of his chair. Circle activity begins with the students answering questions pertaining to the weekly jobs, calendar, weather and the daily schedule. Answers are given using the communication boards with either a light pointer or the child using his hand to point. CJ uses the Touch Talker and DJ uses the ward to scan over the bar code to verbalize his answer or thoughts. PJ and KJ verbalize their answers.

Each student also has a calendar for the week using stickers they place in the appropriate spaces with assistance from the adults. BJ and CJ use their optical light pointers to choose the sticker and where the adult is to place it on the calendar. On this worksheet is a place where we write in special events that have occurred for each day. Through the use of the communication systems the students are able to communicate what they want written on the worksheets. At the close of circle the students break up into groups for language and reading.

As our students get older, more responsibility will be placed on them to follow a daily schedule that is different each day. They need to develop an understanding of the concepts of time according to days, weeks, etc. Along with telling time so that they will be on time for class or work. Teaching about the weather is important in the respect that eventually these students will be responsible choosing appropriate clothes. Throughout this year, my students demonstrated acquisition of these concepts in stating what special activities are scheduled for the day and let us know when it is time to get ready to go home. They are real clock watchers.

Language

Language group consists of KJ, MJ, PJ with an associate. In this they work on communication skills and understanding concepts such as: prepositions, categorizing, naming/signing common pictures and actions, etc. MJ is beginning to use a communication board by pointing to the pictures in a 1 to 2 word response in the group. He does very well at imitating your signing and will at times use the signs spontaneously in group. MJ is showing an interest in using the magic ward to communicate; this may be developed for him next year.

Reading

Reading group consists of BJ, CJ, DJ. The boys work individually with an adult on a worksheet or the computer. At the end of finishing the activity they go to the next reading activity. Each adult has an activity designed to meet that students' needs in the reading program. At this time we are using the Edmark Reading Program 1 on the computer and off. In working on the computer we need the use of the adaptive firmware card and a single switch that is mounted on the wheelchair. To use switches with more than one student, I mounted it on the E-Tran stand and that works very well. I have found both boys are able to control the switch with their heads when the switch is placed at the back of CJ's head, and at the side of BJ's head.

Once the switch is in place, I then set up the reading program for that student. The program is on a scanning system in which the boys press the switch when the arrow is on the answer of their choice. At the end of the program they may get a printout of their score. The boys enjoy this and are able to take it home to show their families how they did that day. It is also a good way to keeping the reading data up to date. On the worksheet activity the boys are either using their light pointers on headstick or mark the answers. DJ uses sign in

reading his words when doing the worksheets. He enjoys working with our foster grandmother on this activity.

The long term goal for our students is to help them become better communicators in the future. Through the use of language development and understanding basic concepts it will also help the student follow directions and complete a task in his living and working environment. The long-term goal for reading is to enable the student to have a larger vocabulary to draw from on a communication board and to communicate his ideas and needs in a more detailed structure of sentences. Another goal is using reading as a leisure activity. This instruction fits with the longitudinal matrix presented in Chapter I.

Math

In the area of math and number concepts the students' goals range from one-to-one correspondence, number recognition, counting, money recognition to counting simple change, telling time, and beginning addition/subtraction skills. Our students are divided into groups according to the skills they are working on.

The assistive equipment we use to help achieve our goals are: the computer and related software, dial scan with a single switch or left-right switch and a large clock. Personal equipment includes: BJ and CJ's light pointers and headsticks, DJ's magic wand with math/number bar code boards, and an electric typewriter.

In working on the computer with students who are capable of using the keyboard, we modify it by covering up all distracting keys with cardboard that has cut-outs for the keys to be used. Depending on the student we may enlarge the number on the keys by using a sticker with the number largely printed then placed on the key. Through the use of the computer our students counting and number recognition skills have improved.

BJ and CJ use their headsticks to operate the keyboard on the computer when doing their math programs. The boys also use their headsticks to type in answers on a worksheet using the electric typewriter. For easy access and visability a wooden wedge is placed under the computer and typewriter.

The dial scan is another useful tool in helping the student to achieve his goals. The dial scan is a versatile piece of equipment because you can make overlays to meet the needs of each student. It is operated with a single switch or the L-R switch - which allows the student to move the pointer forwards or backwards. This cuts down the time for the students reponse.

BJ and CJ can also use the dial scan by placing the switch on the E-tran stand in position for the boys to use their heads to control the switch.

DJ uses the Magic Wand and customized bar code boards to verbally show his knowledge of the math skills. I have found that signing the numbers is difficult for students who have some fine motor difficulties. When DJ is given a worksheet he uses the typewriter or number stamps to write in his answers. PJ also uses the typewriter and number stamps to do his math worksheets.

Students who are unable to use the keyboard and need larger spaces to press in order to operate the computer find that the expanded keyboard (Unicorn Board) is a useful tool. The expanded keyboard is used with the adaptive firmware card. Through the AFC, the Unicorn board may be programmed to run the software you are using with the other students. Customized overlays are made for the Unicorn Board to match the program being used.

BJ and CJ use a large clock with movable hands and their optical light pointers. The boys use the light to show the adult where to place the hands to indicate the time that has been written on a card or the chalkboard. They also use their lights in pointing to stickers that the adult places on their worksheet.

As students develop math and number skills it will help them in the future to purchase items in a store, do counting tasks on a job and provide personal information, etc. For example, the dial scan is useful in teaching coin recognition and value for students who can not indicate by normal motoric or verbal means.

Writing

Writing skills help the student to develop fine motor control. They work on letters in the names and numbers in addresses. The students work on a one-to-one basis with an adult on their writing program and while they are doing this, the other students are working on

independent work skills. The independent work given to the students are tasks they are already able to do.

During this time BJ and CJ are working on their spelling, using the reading words they already know. The boys use the computer and the typewriter to do their work. The boys work individually with an adult, one on the computer and the other on the typewriter. To operate the instructional equipment the boys use their headsticks. Another spelling activity is a worksheet with scrambled letters on stickers. The boys use their light pointers to spell out the words as the adult places the letters in order. Sometimes we give them worksheets where they are to fill in the missing word, using the scrambled letters.

As our students get older they may be expected to write their personal information in a work job setting. For the student functioning at a higher level, may be using their writing and spelling skills in communication with others or for leisure activities. As technology advances our students who have multiple physical handicaps may someday be able to write independently. But first they need to acquire the skills for writing and spelling.

Leisure

Leisure time follows the students lunch hour, while our associates have their lunch break. During this time the students choose the activity they want to do. This time is also used for individually therapy positions. BJ is in the side-lyer, CJ is in the supine stander, and MJ is in the corner chair for stretching therapy. BJ and MJ like to share a taped story. The equipment BJ uses is the page-turner, which is battery operated. MJ uses the able net switch to operate the tape recorder. The able net unit is set for 90 seconds and at the end of this time, the tape recorder shuts off and MJ hits the switch to turn the recorder back on. When the sound on the tape is heard to turn the page of the book, BJ hits the switch on the page turner to turn the page. CJ likes to play card games with his classmates and our foster grandmother. The students use card holders to help hold their cards, CJ's is propper up on the supine stander tray. CJ uses his light pointer to point to the card he wants to pay and grandma plays the card for him. Other leisure activities the students like to do are: board games, listen to records, play computer games with a friend and Systems 80 (a machine that uses a record and slide film to help students learn various academic skills).

As our students get older they need to develop leisure and social skills. This will be a lifetime activity for them. The more they can learn and do, the better off they will be once they are out of school and have more time on their hands.

Vocational

Our students participate in a variety of vocational training activities such as: stapling, pencil sharpening, collating, working in an assembly line, and working independently on a task. BJ, CJ. MJ use the able net switch to operate the electric stapler, electric scissors and pencil sharpener. The able net is set for direct use; this allows the equipment to only operate when the student presses the switch, an adult is always there to assist.

As the students develops good working skills and the ability to perform several vocational tasks, they will be prepared for work in sheltered and supported work settings.

Afternoon Language

The last activity in our day is a language enrichment program. The students are involved in many activities, utilizing the equipment described previously. The standard equipment used by BJ and CJ are their light pointers and communication boards. DJ uses his Magic Wand with customized boards designed for the lessons. BJ is usually in the supine stander for his stretching therapy.

Through the many activities of the program it enables the students to gain new knowledge and reinforces what they already have learned or are in the process of learning. It develops good socialization and communication skills needed throughout their lives.

Art

Our students have art once a week for an hour. Our associates assist the art teachers in the projects. BJ and CJ use their headsticks for painting and coloring. The paint brush and crayon tips are taped onto the end of the stick. The paper is elevated for easy access. In cutting activities the boys use the electric scissors with the use of the able net switch. The unit may be set on direct use in which the scissors will only operate while the student is pressing the switch. It can also be set for several seconds and at the end of the time set, the scissors will shut off then, the student will need to

press the switch to operate the scissors, as the adult is operating the scissors around the cutting lines. The students have increased their attention span by watching the scissors cut on the line. When the unit is set on direct use the student needs to watch the scissors carefully, so that when it is time to stop cutting they will release the pressure on the switch, turning the scissors off.

Using the adaptive equipment during art helps the student develop more motor control and gives them training in leisure skills.

Community Mobility

Community mobility poses many challenges for our students in communicating with store employees. Our speech clinician has helped us in making the communication boards for use in the community and in the classroom. She has also programmed the light and Touch Talkers and the All Talk. Through these devices our students are able to communicate their needs in the community. DJ uses the Magic Wand with the customized community mobility bar code notebook. He carries the main unit in a back pack which enables him to hold the notebook and scan the bar codes to communicate with us or store employees. MJ uses a pictorial communication board out in the community and a small dog shaped tape recorder to use in ordering his lunch as a fast food restaurant.

The long term goals we are striving for out in the community are for the student to become as independent as he can in his communicating, mobility, purchasing skills and in ordering the eating in a restaurant.

My hopes are that through this description, teachers are able to see how we have incorporated technology into our daily schedule.

In the next section I would like to share with you a task analysis for instructional programs using the adaptive equipment discussed in this chapter. I have found that these task analysis have been very helpful for our classroom staff and anyone who comes in to work with our students. It cuts down on the amount of time explaining how to work with our students and the equipment. Following the figure listing the task analysis is a table listing all the equipment used in our classroom.

Figure 3
TASK ANALYSIS FOR INSTRUCTIONAL PROGRAMS USING ADAPTIVE EQUIPMENT

LIGHT POINTER W/WORKSHEETS, COMMUNICATION & ACADEMIC BOARDS

1. Place student in position as designated on program.
2. Place both trays on wheelchair.
3. Place appropriate comm. academic board or worksheet on vertical ray. Use colored slips to hold materials on board.
4. Place Light Pointer on students head and turn on light.
5. Give student verbal cue according to program.
6. For correct responses, give verbal praise.
7. For incorrect responses show the student the correct answer and practice.
   "No, (Student's name) this is..." "Put your light on the ..."
   "Now lets practice..." Give verbal praise
8. Mark data sheet appropriately after each trial.
9. Upon completion of the activity give the student a sticker on worksheet and on sticker card.
10. Turn off liiiight and remove from students head. Remove all other materials. All worksheets are to be plaed on the teacher's desk.

HEADSTICK W/WORKSHEETS AND WRITING PROGRAMS

1. Place student in position as designated on program.
2. Place large tray on wheelchair.
3. Place worksheet on tray with top & bottom taped down.
4. Place appropriate writing equipment on end of headstick: crayon tip, pencil, marker, with tape.
5. Give student verbal praise.
6. For correct response give verbal praise.
7. For incorrect responses show student the correct answer or how to use the headstick in the writing programs.
   "No, (student's name) this is..." Practice using the headstick on another sheet of paper, then go back to original worksheet.
8. Mark data sheet appropriately after each trial.
9. Upon completion of the activity give the student a sticker on the worksheet and on sticker card.
10. Remove the headstick and the writing tip. Place work on teacher's desk.

SYSTEMS 80 WITH LIGHT POINTER

1. Place student in position as designated on program.
2. Place appropriate record and film slide into the machine.
3. Place light pointer on student's head and turn on.
4. Upon the verbal cue of the machine, the student wil point to the answer on the screen. Push the button under the answer student has given.
5. Mark the data in the student's System 80 folder and in Functional Academic folder: #correct/total # of questiosn.
6. When record is over put all materials away. Remove light pointer.

TYPEWRITER WITH HEADSTICK

1. Place student in position as designated on program at the typewriter table.
2. Place worksheet in tyepwriter and set on appropriate line.
3. Place headstick on student and turn on typewriter.
4. Give student verbal cue according to program.
5. Student may need verbal cues to find the keys on typewriter.
6. For correct response give verbal cue.
7. For incorrect response show student the correct answer and practice typing and finding the appropriate keys.
8. When beginning to type new material place a written copy of the item the student is to type. After student has mastered it remove copy and work on typing it by memory.
9. When finished turn typewriter off and remove work.
   Remove headstick from student
   Place work on teacher's desk.

DIAL SCAN USING LEFT/RIGHT SWITCH

1. Place student in position as designated on program.
2. Place large tray on wheelchair with L/R switch.
3. Place Dial Scan on wheelchair table so that it is at eye level. Place appropriate materials on the Dial Scan to be worked on.
4. Give verbal cue to student.
5. Student will hit the switch L or R to move the dial to the answer on the Dial Scan.
6. For correct responses give verbal cue and Mark data sheet.
7. For incorrect response show student the correct answer and help student move the dial to that answer. Practice several times finding the answer. Mark data sheet.
8. Upon completion of the prgram give student a sticker on card.
9. Remove all materials and put away in appropriate place.

COMPUTER PROGRAMS WITH USE OF SINGLE SWITCH

1. Place student in position as designated on program.
2. Place computer program as designated on program, in the computer and set up for student.
3. Place approrpiate switch in position for student to use. Only staff that have been trained as to the switch operation and set up for the computer will run the computer programs.
4. Begin the computer and student will respond to the answer by hitting the switch. Work with student on hitting the switch within the time limit. On data sheet mark how the student operated the switch and ability to answer the questions appropriately plus any other comments as to the students ability.
5. Practice using the switch and getting to know the program when beginning a new computer program.
6. For correct response, give verbal praise.
7. For incorrect response have student practice using switch on the next few sections with in time frame or correct use of the switch.
8. Upon completion of the computer program give student a sticker on card and turn off computer.
9. Remove switch from it's position and place back on appropriate shelf.

CALCULATOR WITH USE OF THE HEADSTICK

1. Place student in position on program.
2. Place calculator on wheelchair mount plae on E-Tram. stand and place at side of student with calculator in front of student.
3. Place headstick on student.
4. Give verbal cue as to what the student is to work on.
5. This may be paired with the typewriter and worksheet. Student first reads the problem on the worksheet then works it out on the calculator, then types in the answer on the worksheet. Adult will assist in the removal of the equipment and operation if needed.
6. Give verbal cues when appropriate and verbal praise for correct response.
7. For incorrect responses go over the problem and show student how to work the problem out on the calculator. Practice several times before going on to the next problem.
8. Mark data after completion of worksheet and any comments.
9. Remove all equipment and put back in it's appropriate place.
10. Give student a sticker on worksheet and on sticker card. Place work on teachers desk.

Our classroom has a heavy concentration of students who both need and can benefit from use of technology in various forms. Table 4 provides a list of the devises which we use.

Table 4

Equipment Used in Classroom for Students with Multiple Handicaps

Computer:

Apple IIe
Color Monitor
2 Disk Drives
Epson Printer

Adaptive Peripherals:

Adaptive Firmware Card
Echo Speech Synthesizer
Power Pad
Touch Window
Unicorn Board
Joy Stick
Plate Switch
Switch Interface box
Zygo Switch
Scooter Interface for Power Pad

Communcation Systems:

Electronic Beeper
Touch Talker
All Talk
Magic Wand & bar codes
Light Talker

Other Electric/Electronic Adaptive Equipment:

Dial Scan & wheelchair mount
Left-right switch (used with dial scan
2 Able-net swtiches and Control Units
Electric stapler
Tape recorder
Electric scissors
Environmental control remote switches
Wheelchair chair mount
Systems 80 Machine
Electric page turner
Electric pencil sharpener

In this chapter, I tried to depict how our students are able to participate in many typical activities provided to sutdents with mild mental handicaps. The opportunity to use technology and integrate it into classroom instruction has made learning more productive for these students. The following chapter provides examples of how technology benefits individuals students with severe disabilities and what long term benefit it will provide.

Chapter V
TEACHING USE OF TECHNOLOGY AND COMPUTERS TO THE INDIVIDUAL STUDENT

by Jan Weiberg

The uses of technology in the severe/profound classroom is as varied as the classroom population. A student with severe physical handicaps who is strongly motivated to communicate is often in the same classroom as the child with severe motor and sensory impairment who seldome interacts with the environment. The computer is versatile enough to be utilized by both students.

Perhaps the computer has the most to offer the student functioning at the profound level. It is that child and his/her teacher who are stymied by lack of appropriate curriculum and motivational instructional tools.

The following case studies are presented to illustrate the purpose and benefits of using computers and other electronic technology with students functioning in the severe and profound range:

Case Study: Alex

This is a case study is a good example of how to relate computers and technology to the child who is difficult to relate needs and meaningful and age appropriate school programs. The child is hard to motivate and staff burn-out is frequent.

Alex is a six year old student with severe physical limitations. He is very social and sensory capabilities are adequate. At first glance the teacher would expect Alex to be able to respond to people using an eye gaze and attempt to interact with his environment. Alex is fed through a stomach tube which further limited his progress in a functional curriculum and lifestyle. The teachers worked with pictures, objects, switch operated toys, fans, music and television. Data showed no motivation to operate and control his environment. Alex seemed content to watch the activity and let people come to him. The teachers accept this but approached the computer with Alex as another tool to motivate him to control something and as a possible tool to communicate expressively and receptively.

If you refer to the Instructional Flow Chart (Appendix A), Alex began his computer introduction at the basic level. He has adequate sensory capabilities and is able to operate a switch with finger tip movement if the switch is secured to a wheelchair tray. Another possible means of switch operation would be through head turning but that would have interrupted his attention to the screen. Alex was introduced to software to verify concept of Cause/Effect. Early Switch Games, Motor Training (UCLA) and Interaction Games were favorites. "Music/Noises" games on Interaction Disc are recommended for initial cause/effect programs with sensory limited students. Data was collected on the number of times Alex hit the switch to change the picture or sound. He showed a definite preference for the silly sounds on the Interaction Games disc. Alex was then introduced to discs that require simple auditory and visual tracking or choice making. These were not met with rapid success or interest and the teachers are training the skill. This system of instruction is demonstrated in the teaching loop of Instructional Hierarchy and Flow Chart.

Future Considerations:

The onset of technology in the classroom and home environments has opened doors to individuals with profoundly physically and mentally handicaps that would never have been considered a decade ago. The freedoms and outlet for independent thinking are still limited to the amount of time and staff has available to prepare for student use.

The long range computer enhanced goals for Alex would be primarily a leisure activity. It would be appropriate for him to select his preference of activity but the access will be using an apporpriately placed single switch. At the present time, Alex's interest in the computer is a leisure activity and its reliability over other switch-activated activities warrants time allotment in the school day.

Alex will also have the option of controlling an activity such as television or turning on a fan (especially important to him because his body temperature is inconsistent.)

Technology will provide enhancement to Alex's life. Who knows where we'll be in education in another decade. It has given educators, especially Severe/Profoundly handicapped

children a new outlook on their students. Perhaps that is one of the greatest benefits.

Case Study: Tom

Tom is a student who has already benefitted from working with computers and technology in the classroom and will achieve greater independence in the future because of technology in his life. He is a social seven year old functioning in the upper range of severe capability. He is nonambulatory with adequate vision and hearing. He has improved fine motor control while wearing simple wrist supports.

Tom communicates by pointing or gesturing; shaking his head yes/no, and by a language board with line drawings. He is able to initiate computer work through these methods and requests the computer daily.

The computer is used with Tom as a leisure activity and as a primary teaching tool. He maintains attention to the task and enjoys learning from it as much as with the teacher. During his free time he is able to select the computer from a range of pictures on his language board and then choose the game or disc he prefers. When he wants a change he can hit a beeper placed on his wheelchair tray. The majority of the time his access to the computer is by switch although he enjoys key board control for such activities as the "Alphabet" (DLM). The keyboard control doesn't appear meaningful at this time. Tom established understanding of cause/effect and choice making before introduction to the computer. He is able to control four items in the classroom with the use of an Environmental Conrol Device available through TASH in addition to switch activated toys and equipment. So the staff introduced software to establish simple scanning skills. Software used included Early Motor Training Games (UCLA) such as Frog and the Fly, Basketball, and Anti-aircraft. These were not as challenging to Tomas Dynacomp's Early and Advanced Switch Games. Tom mastered simple scanning with these activities. The teachers had difficulty locating software to strength scanning that were motivating to him but not too high cognitively. Some pre-reading software such as Sticky Bear were used but require more teacher prompting and a move from autoscanning to direct selection.

Tom's language board was adjusted to fit onto overlays for use with the Power pad. This allows for improved association of pictures to their meaning and the auditory reinforcement.

The Power Pad provides introduction to a portable speech output communication system.

Future Considerations:

The long term goals are easier to formulate for a child with Tom's abilities. He will be able to control basic items in his environment such as lights and television. He will also be able to move independently through an electric wheelchair. Tom will be able to communicate with a variety of people using a small,. mobile communication device such as a Prentke-Romich Intro-Talker. His cognitive skills will continue to develop as he is able to communicate expressively and as intermediate as software is developed.

Case Study: Jim

Jim is a visually impaired student who has good use of his arms for switch use. He does not have the fine motor necessary for keyboard control so he was introduced to the computer using switch access. Jim showed understanding of cause and effect, controlled his environment and his daily schedule by making choices when offered. His verbal skills were enough to communicate some want/needs. The computer was introduced as a leisure activity at school and his parents were encouraged by Jim's motivation and pleasure to provide one for home use. The computer allows Jim to occupy his time alone, interact with his family using simple games and closer approximate the activities of children his age.

Future Considerations:

Jim is a good example of a student who can continue to use technology to enhance the functionally based curriculum. His school time is appropriately spent learning to care for basic needs, improving verbal skills, becoming more independent in simple domestic tasks. His computer work will supplement the program developed to strengthen Jim's independence. The mode of access and basic computer skills learned at school may now

be continued in his home environment as he and his parents see fit.

For the majority of the students in this classroom in this project, the computer is used as a teaching tool. It was not expected that they would use the computer without supervision or to communicate and independently control their environment. The computer enhances their lives and provides motivation for independent activity and thinking. But it is not relevant to their primary functional needs. For example, learning to walk and explore the environment, use a spoon independently, or relate a purpose with a simple object. The computer enhances the curriculum but is not the most important mode of instruction.

An example of using the computer as an alternative means of instruction is using the Power Pad. The entire class is able to work with the Power Pad as a small group. Using the "Wheels on the Bus" software (UCLA) the students can be involved in a group music period and continue work on individual goals. While one student is learning to take turns, another to choose a verse upon request, and another to associate pressing a picture to hear the music (cause/effect).

The Power Pad can be used to support a language board as mentioned in the earlier case study or can be used as a primary tool to access cognitive skills. A blind student showed no preference to select between objects or a tactile language board. The Power Pad can be used to give tactile and auditory input with little teacher input. It is another method to access cognitive skills in low functioning children.

In addition to using the computer as a highly motivating instructional tool for communication, attention to task, cognitive skills level instruction it can be a reward. One student would control and move a walker the distance of the room in order to get to the computer. The therapist had worked for months to motivate movement let alone directed movement and the computer achieved success and provided no physical, verbal or gestural prompts! The teacher is also able to demand the very best behavior at the computer for increasing amounts of time from students learning to sit and maintain attention and those with severe behavior problems. The computer is attractive to students who resist direction from adults.

One boy exhibiting autistic behaviors related to computer directed instruction more readily than the teacher direction. There was less time controlling behavior and more time in quality instruction. The teacher is able to keep the students interest by adding new software, a new switch, or new peripherals. Because of the advances in technology the teacher can

have confidence that computers will continue to play a role in the loves and education of children of all ages, cognitive levels, and physical handicaps.

Technology has much to offer the classroom teacher and her students. It is important to remember it must be used as a means to an end and not as an end result.

"Helpful Hints"

To avoid students hitting the Escape buton a block can be made with cardboard and masking tape to cover a portion of the keyboard.

Chapter VI
Summary

Teaching use of computers and other electronic devises is essental because it represents the world our students will live in during the 21st Century. This instruction must be based upon the fundamental intent of helping students with multiple handicaps become more independent in their daily lives. Computer use can be nonfunctional if it is not built into a sequence leading to acquizition of practical applied skills.

Further, funtionality occurs in application of cognitive levels that are related to technology access. Functional application may be made using electronic equipment and computers for students performing at levels requiring understanding of cause and effect, choice making, sequencing and combined functions, such as, scanning.

When making application or conducting cognition related training, computers and peripheral equipment must be carefully matched to the student. Software requires the same level of concern in that it must be matched to the students' cognitive level and ability to provide motor responses.

Communication training is the most important technological application for many students. Computers and electronic devises can be of great assistance in motivating students to acquire language and gives them a method with which to use language expressively. Other adaptive equipment can be used for functional use and language acquisition.

Instruction using a wide variety of adaptive devises can be integrated into the daily instructional routine. Students who use computers to learn to read, write, and compute illustrate the applied component of our instructional decision making paradigm in the same manner as a student who uses the remote switch to turn on a room fan.

Individual students can benefit from instruction using computers and other technological innovations. The most important factor when choosing instruction with a piece of equipment is for the instructor to know what long-term benefit it will have for the child.

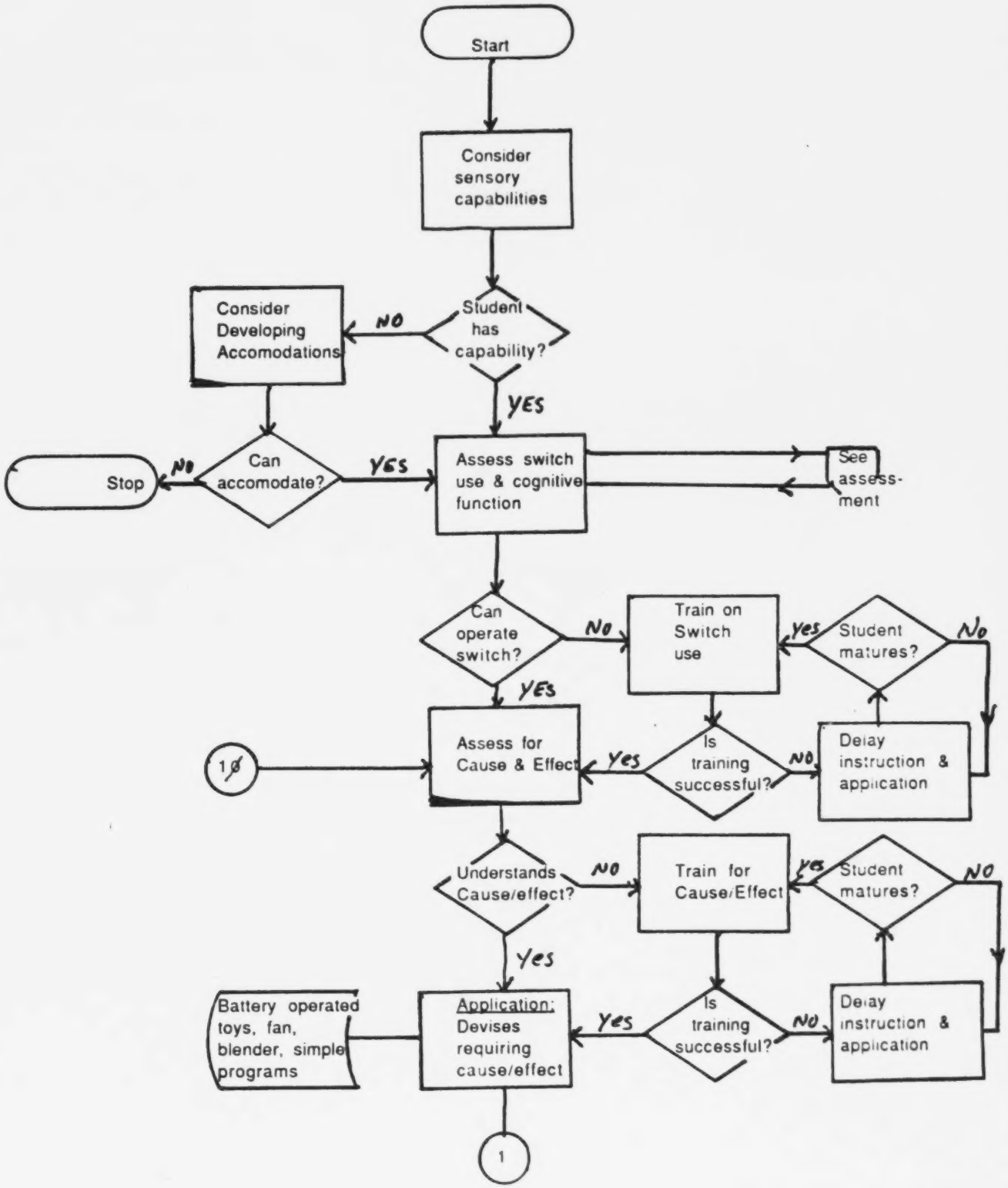
The model presented in this monograph is a heuristic one (meaning learning) upon which we intend to study further. Until more

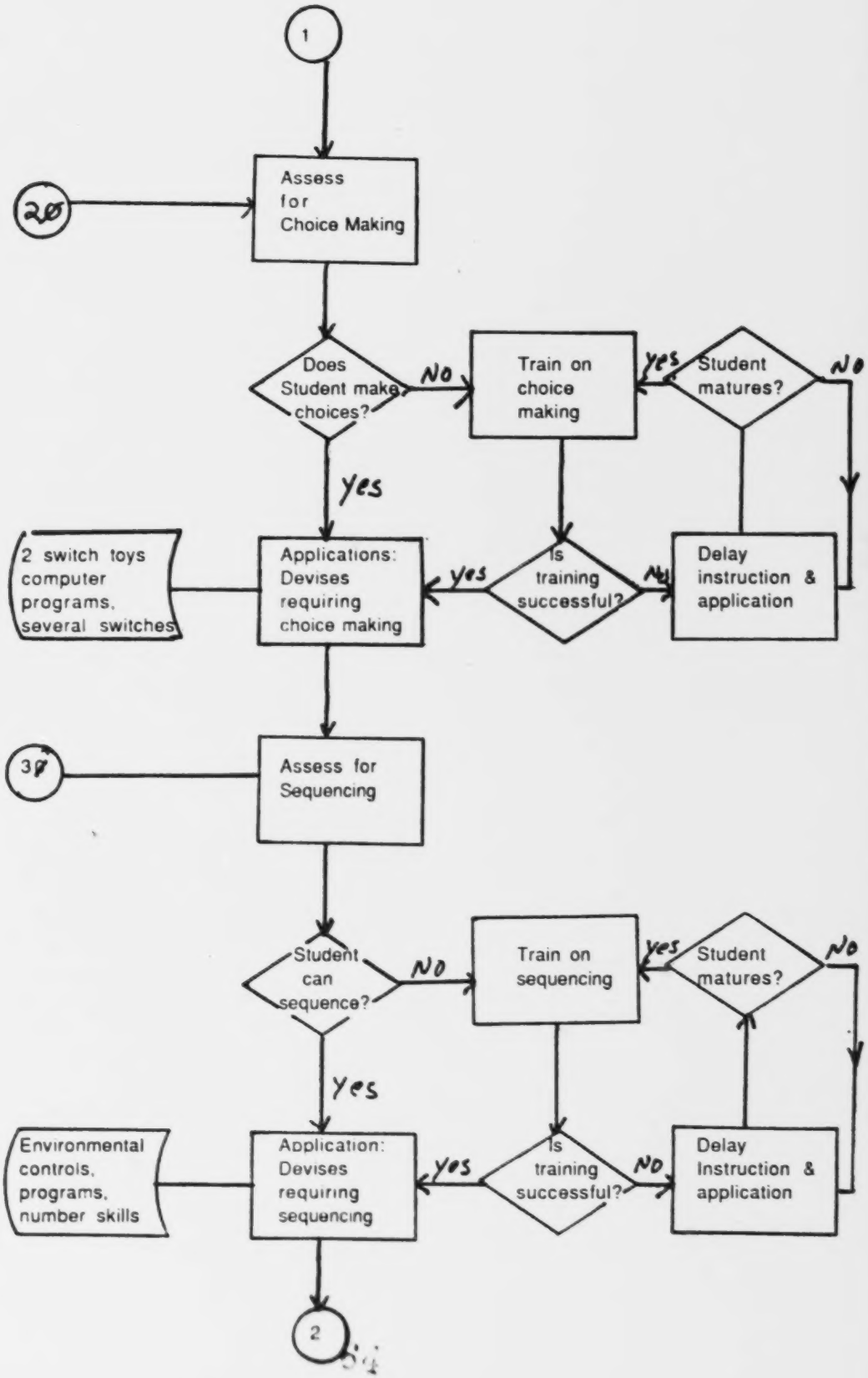
research can be conducted, this model will serve as the rationale and sturucture that will guide our instructional practices. In addition, the model provides a conceptual structure which assists in improving and organizing our communications between each other regarding why, what, and how we teach using various pieces of advanced technology. We anticipate that as our use of technology matures, the model presented here will change. For now, our communications are better and we have a clearer understanding of the purposes and long term benefits associated with use of technology for students with multiple handicaps. We hope that other school programs will be able to use these concepts as a starting point in discovering how to prepare their students to live in the next century.

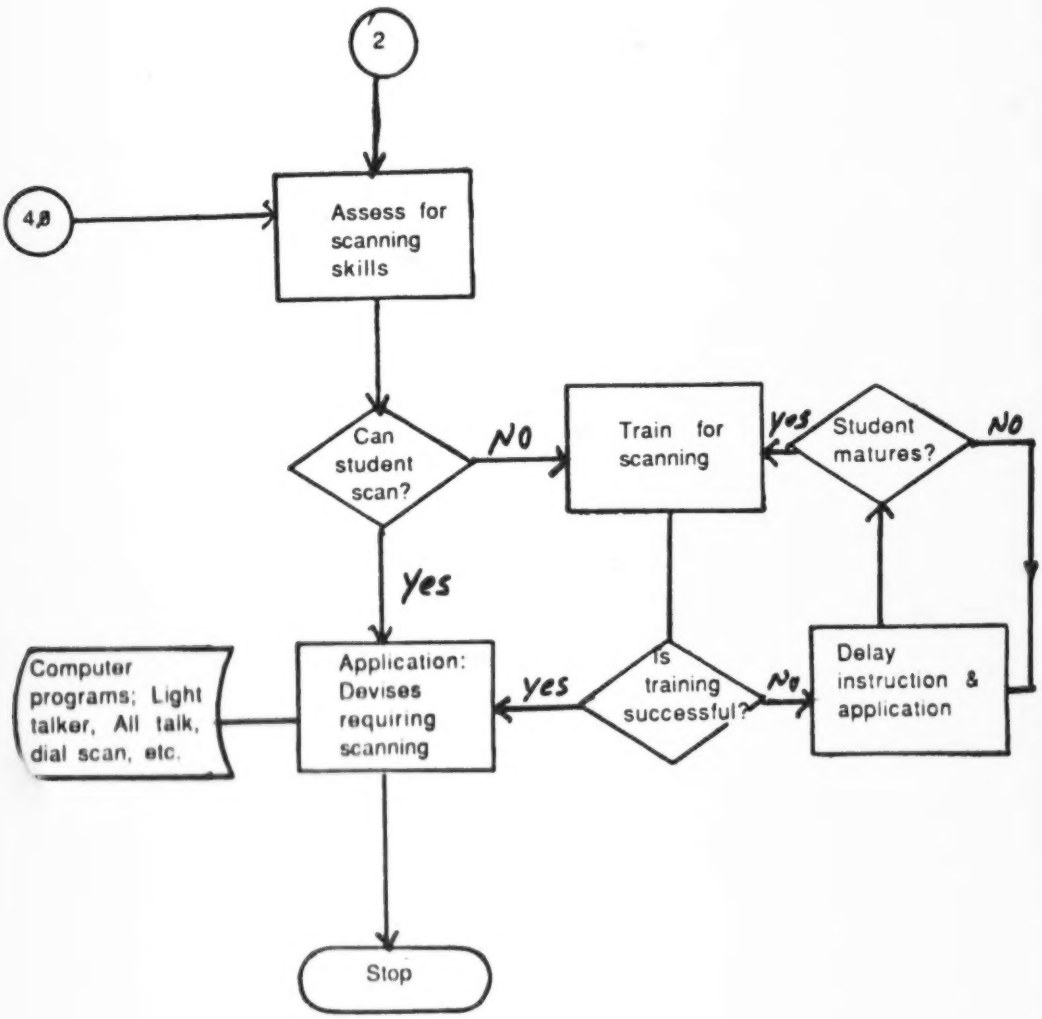
APPENDIX A

INSTRUCTIONAL DECISION MAKING FLOW CHARTS

INSTRUCTIONAL PROGRESSION AND DECISION MAKING FLOW CHART




1
20
Assess for Choice Making
Does Student make choices?
NO
Train on choice making
yes
Student matures?
NO
yes
2 switch toys computer programs, several switches
Applications: Devises requiring choice making
yes
Is training successful?
NO
Delay instruction & application
30
Assess for Sequencing
Student can sequence?
NO
Train on sequencing
yes
Student matures?
NO
yes
Environmental controls, programs, number skills
Application: Devises requiring sequencing
yes
Is training successful?
NO
Delay Instruction & application
2


2
4B
Assess for scanning skills
Can student scan?
NO
Train for scanning
Yes
Student matures?
NO
Yes
Computer programs; Light talker, All talk, dial scan, etc.
Application: Devises requiring scanning
yes
Is training successful?
No
Delay instruction & application
Stop

APPENDIX B

COMPUTER EVALUATION FORM

COMPUTER EVALUATION FORM
for Students with Multiple Handicaps

Child's Name: _____ Date:_____
Positioning of Child:

Positioning of computer hardware and peripherals:

Motor skills used to access the computer:

___ Isolated finger movements
___ Use of one finger
___ Use of headstick
___ Whole hand to activate an expanded keyboard
___ Whole hand to activate a switch
___ Head to activate a switch
___ Use of other body part to activate a switch
Explain:
___ Use of swiping motion to activate a switch

Cognitive skill level:

___ Conditioning
___ Cause and effect
___ Making choices
Number:
___ Picture identification
___ Matching
___ Sequencing
___ Scanning

Perceptual skill level:

___ Functional vision
___ Functional hearing
___ Eye contact with the monitor
___ Maintains attention with vision or hearing
___ Visual tracking-scanning
___ Visual and auditory discrimination
___ Eye-hand coordination

Peripheral Input:

___ Single Switch
Type:
Location:
___ Multiple Switches
Type:
Location:
___ Powerpad
Number of spaces:
Size of spaces:

Evaluation form continued--

___ Unicorn Board
  Number of spaces:
  Size of spaces:
___ Joystick/Paddle
___ Touch Window
___ Computer Keyboard
  Adaptions:

Method of Input:

Direct select
Scanning
  Number of items scanned:
  Time alloted for scanning:
  Single or group scanning:

Software:

Conclusion:

Position of child:

Movement used to activate computer:

Peripheral input used:

Location of peripheral:

Method of input:

Software used:

Goals for using the computer:

APPENDIX C

FORM A-SOFTWARE REVIEW

Form A

Program Name: _____

Program Description:

Equipment Needed

How to Use

APPENDIX D

FORM B-SOFTWARE INVENTORY

Form B

Software Inventory

oftware Name:	Skills	Input Method: (S) Scanning (D) Direct select	Printer	Echo	Keyboard	Switch 1 or 2	Powerpad	Unicorn & Adaptive Firmware Card	Touch Window	Adaptive Firmware Card & Switch

APPENDIX E

RESOURCES

Note: This resource list was prepared by Dr. Liz Lahm from the Council for Exceptional Children. Dr. Lamb was an excellent resource to our project.

RESOURCES

Switch training and Communication

Choice Maker I	Microcomputer Systems for the Handicapped 10418 Armstrong Street Fairfax, VA 22030
Control Without Keyboards Simple Com I	Dunamis, Inc. 2856 Buford Highway Duluth, GA 30136
Motor Training Games Picture Communication	ComputAbility 101 Route 46 Pine Brook, NJ 07058
Talking Touch Pad	B.O.C.E.S. 2 Special Education Microcomputer Resource Center 8 - 43rd St. Centereach, NY 11720
Point to Pictures Series Touch Com	Don Johnston Developmental Equipment 900 Winnetka Terrace Lake Zurich, IL 60047
Rabbit Scanner	Handicapped Chilren's Computer Cooperative Project c/o Sherwood Center 7938 Chestnut Kansas City, MO 64132
Echo Textalker Disk	Street Electronics Corp. 1140 Mark Ave. Carpenteria, CA 93103
Exploratory Play Representational Play Kidtalk	Peal Software 3200 Wilshire Blvd., Ste. 1207 Los Angeles, CA 90010

Software for Concept and Language Development

Alphabet Circus Number Farm	Developmental Learning Materials One DLM Park Allen, TX 75002
Charlie Brown's ABC	Random House School Division 400 Hahn Road Westminister, MD 21157

First Words First Verbs Microlads First Categories	Laureatte Learning Systems, Inc. 100 East Spring St. Winooski, VT 05404
Public Domain Software	Project C.A.I.S.H. Gocio Elementary School 3450 Gocio Road Sarasota, FL 33580
Finger Painting	Nova Software P.O. Box 545 Alexandria, MN 56308
Muppets on Stage Muppetville	Sunburst Communications RM # FQ05 39 Washington Ave. Pleasantville, NY 10570-9971
Wheels on the Bus Worm Squirm Rockets to the Moon Dinosaur Game plus others	LAUSD/UCLA Microcomputer Team 1000 Veteran Ave. Room 23-10 Los Angeles, CA 90024
Early Discovery Series	Hartley Courseware, Inc. Box 431 Dimondale, MI 48821
Adventures of Jimmy Jumper	Handicapped Chilren's Computer Cooperative Project c/o Sherwood Center 7938 Chestnut Kansas City, MO 64132
Early Learning I Early Learning II	Marblesoft Systems P.O. Box 7012 Rochester, MN 55903
Sticky Bear Opposites	Xerox Education/Weekly Reader 245 Long Hill Road Middletown, CT 06457
Facemaker	Spinnaker Software 215 1st St. Cambridge, MA 02142
Paint with Words	MECC Publications Dept. 2520 Broadway St. Paul, MN 55113

LEARNING TOOLS

Magic Slate	Sunburst Communications Room # FQ05 39 Washington Ave. Pleasantville, NY 10570-9971
Talking Text Writer	Scholastic Software 2931 East McCarty Street P.O. Box 7502 Jefferson City, MO 65102
Dr. Pete's Talkwriter	Hartley Courseware, Inc. Box 431 Dimondale, MI 48821

VOICE OUTPUT

Echo synthesizers II, II+, Cricket, GP	Street Electronics Corp. 1140 Mark Ave. Carpenteria, CA 93103

OTHER OUTPUT DEVICES

Omnibox	Expert Systems Software, Inc. 923 Van Leer Drive Nashville, TN 37220

SWITCHES & SWITCH INTERFACES

switches	Creative Switch Industries P.O. Box 5256 Des Moines, Iowa 50306
switches, interfaces	Prentke Romich Company 8769 Township Raod 513 Shereve, OH 44676-9146
switches, interfaces	Don Johnston Developmental Equipment 900 Winnetka Terrace Lake Zurich, IL 60047
switches, interfaces toys	Steven Kanor Ph. D. Inc. 8 Main St. Hastings-on-Hudson, NY 10706
switches, interfaces	TASH Inc. 70 Gibson Drive, Unit 1 Markham, Ontario L3R 2Z3
switches, interfaces	Zygo Industries, Inc.

P.O. Box 1008
Portland OR 97207

ALTERNATE KEYBOARD & INPUT DEVICES

PowerPad	Dunamis, Inc. 2856 Buford Highway Duluth, GA 30136
Adaptive Firmware Card AFC Set Up Disk	Adaptive Peripherals, Inc. 4529 Bagley Ave. N. Seattle, WA 98103
Omnibox	Expert Systems Software, Inc. 923 Van Leer Drive Nashville, TN 37220
TouchWindow Muppet Learning Keys	Sunburst Communications RM # FQ05 39 Washington Ave. Pleasantville, NY 10570-9971

OTHER RESOURCES

Technology-Assisted Contingency Training Materials
CMECSU Technology Project
St. Cloud State University
Education Building B109-1
St. Cloud, MN 56301

Homemade Battery Powered Toys and Educational Devices for Severely Handicapped Children
Linda J. Burkhart
8503 Rhode Island Ave.
College Park, MD 20740

Microcomputer Applications Videotapes
Macomb Projects
College of Education
27 Horrabin Hall
Western Illinois University
Macomb, IL 61455
309-298-1634